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# JOURNAL OF FORESTRY

VOL. 37 AUGUST, 1939 No. 8



## EDITORIAL

### A SILVER ANNIVERSARY ON THE GOLDEN PLAINS

FORESTERS naturally enough have a greater and more direct interest in the Forest Service than in any other governmental agency. Many other governmental agencies, however, are engaging in or contributing to forestry activities on an ever broadening front. It is not unlikely, as time goes on, that these agencies will make even greater contributions to American forestry than they are making today.

The Bureau of Plant Industry employs only a small number of foresters, but some agencies of this bureau have made substantial contributions to a considerable number of forestry enterprises. One of the more important of these agencies is the Northern Great Plains Field Station at Mandan, North Dakota, which is now completing twenty-five years of active and fruitful work on prairie tree planting problems.

The federal act authorizing the establishment of a dry land field station in the northern Great Plains area was passed by the Congress in 1913 largely through the efforts and interest of Congressman Louis B. Hanna of North Dakota. During 1914, work in the station building began and some demonstration work on grazing and tree planting was undertaken. Since 1914, the work on prairie tree planting has been carried on without interruption, and the knowledge and experience gained and the experimental data collected serve as the basis for much of the many farm forestry activities now underway in the northern Great Plains area.

In 1916 a shelterbelt demonstration project was undertaken by the station in cooperation with the farmers in the plains section of Montana, North Dakota, South Dakota, and Wyoming. The main objects of this project were to stimulate interest in the improvement of farm homes by the planting of belts of trees near farm buildings and to determine by actual trial the kinds of trees best suited to the different sections and the best methods of handling them. At the end of 1935, more than 4,000 cooperative shelterbelts, varying in age from one to twenty years and involving over four million trees, had been established.

The experience of the Northern Great Plains Field Station with these 4,000 cooperative shelterbelts has shown conclusively that it is possible to start successfully a planting of trees on the average upland farm site in the northern Great Plains; it has shown that with such species as box elder, green ash, and white elm, stock raised from seed procured from native trees is more hardy than stock raised from seed procured from trees in more southern or more eastern localities. In brief, the experience of the station has shown most of the important details of the care and planting of shelterbelts in the northern Great Plains area.

The Northern Great Plains Field Station is not a research station, but much of its work at least has research implications and some important scientific data have been collected as a by-product of its regular work. For example, some years ago, workers at the station became convinced of the desirability of grading forest planting stock on the basis of diameter classes instead of height classes. Today this is the standard practice at many Forest Service nurseries. Workers at the station also have devised effective methods for the

storage and dewinging of American elm seed, a very popular and important tree for prairie planting in the northern Great Plains area. This method permits the storing of elm seed up to eleven months and thus makes possible early spring sowing and the production of suitable planting stock in one season.

The approach of the Northern Great Plains Field Station to prairie tree planting problems has been sane and sound. The station staff seems to have refrained from making extravagant and unsupportable claims. It has called the attention of farmers in the region to the difficulties to be encountered in establishing shelterbelts, as well as to the benefits to be derived from them. It has recognized, and the farmers of the region consequently now recognize, that trees in the northern Great Plains region neither live very long nor grow to large size. Furthermore, the farmers of the region are well informed of the difficulties, the expense, and at times the inevitable failure of attempts to establish trees in the region. Yet they are keenly interested in planting trees and willing to stake their time and their money on the undertaking. The development of such a public attitude by a governmental agency must be regarded as a genuine achievement.

In the summer of 1934, President Roosevelt amazed the Nation by his bold proposal to bisect the Great Plains with a protective belt of trees. His plan called for the ultimate planting of about one-fourth of the total Great Plains area of approximately 400,000 square miles and involved an ultimate estimated expenditure of approximately seventy-five million dollars. On so grand a scale was the project conceived, and under so propituous circumstances was it first announced, that sight was almost completely lost to the fact that in Minnesota alone a somewhat similar project was proposed on two occasions almost fifty years before. Sight also seemed to be lost of the fact that every agricultural experiment station in the region had been encouraging the planting of shelterbelts for the past twenty-five to fifty years.

Furthermore, both in the planning and in the execution of the actual planting program, fullest use does not seem to have been made of the long experience of the station workers in prairie planting. The shelterbelt planting program has been changed and modified materially since it was begun and as additional experience was gained. To one not too familiar with all the details of the project, it would appear that these changes have at least tended in the direction of the prairie planting program recommended for many years by the Northern Great Plains Field Station.

There are many indications that the work of the Northern Great Plains Field Station has not received the recognition by the Forest Service, the Soil Conservation Service, and other governmental agencies it so richly deserves. This station, operating on a budget which in the light of present day governmental expenditures appears to be ridiculously small, and hampered directly and indirectly in many ways, has made both practical and scientific contributions to prairie tree planting of which even a well supported organization might well feel proud.

At times it may be well for all governmental agencies to reflect on the strong possibility of the American public being far more interested in the ultimate results obtained from the expenditures of public funds than in petty conflicts and jealousies between governmental agencies, federal or state. There is still so much unplowed ground in American forestry—so much urgent work to be done that no one need worry much about who is going to plow which furrow.

Anniversaries always should be happy occasions. The many foresters in the Great Plains region interested in prairie tree planting problems take this opportunity to express the hope that the workers at the Northern Great Plains Field Station may find joy in the fact that under very trying conditions they have made significant contributions to one of the most difficult and urgent American forestry problems—prairie tree planting—and the hope that the golden anniversary to be celebrated twenty-five years hence may be an occasion for even greater and wider rejoicing.

# DOES THE LUMBER INDUSTRY NEED A RESEARCH PROGRAM?

By EDWIN C. JAHN

*University of Idaho*[1]

The answer to the question "Does the lumber industry need a research program?" is perfectly obvious. Not so obvious, however, is the equally important question of who should do the research and how it is to be financed. It is one thing for a profitable industry to engage in research to make it still more profitable; it is quite a different thing for an industry by and large unprofitable to engage in research. The steel industry is highly concentrated; the petroleum industry is highly concentrated; the International Nickel Company controls a large part of the world's annual production of nickel. Under such conditions it is a relatively simple matter to undertake a research program. But what about the lumber industry? Here there are thousands of small producers. About one-fourth the total forest area of the nation is in farm woodlands and many of the large owners of forest lands are in financial distress. Under such conditions it is quite unlikely that an extensive research program will be undertaken no matter how badly it is needed. It is not unlikely that the most effective and cheapest way to meet the research needs of the lumber industry is to increase the support of public agencies engaging in research, especially that of the U. S. Forest Products Laboratory and of the various forestry schools.

CONSIDERING wood in any form as an industrial raw material, there is probably no natural resource offering greater potential returns for research expended upon it. The milling and logging wastes, pulp mill wastes, and standing timber not now profitable to harvest make available great volumes of raw material which are for the most part easily obtainable. The efficiency of the present utilization of wood is recognized as very low. This means not only loss of resources but a lower financial return from the forest. The complete utilization of wood from a broad point of view is very desirable.

The lumber industry may put the question simply, as follows: Is it practical and financially desirable for the lumber industry to invest in research? The answer may be found in the replies to the following questions:

1. Is the lumber industry a stable industry? No; it frequently suffers fluctuations sooner and more severe than most great basic industries. It suffers not only from seasonal fluctuation but, due to its close interdependence with the building trade, the percentage of capacity at which the lumber industry operates is intimately related to building activity. The amplitude of the building activity cycle is about eighteen years, but it varied as much as 20 to 60 percent from this average over the past three cycles.

Progressive exhaustion of raw material near established mill sites, with resultant higher costs, and mill relocations both also contribute to instability in the lumber industry. Tariff and freight rate changes, currency changes, foreign developments, and cyclical changes in industrial production affect lumber as they do all other industries.

2. Does the lumber industry enjoy freedom from the competition of other materials? No. Competition is a lumberman's nightmare. Competition with revolutionary ideas which may develop something entirely new that the customer prefers is what most manufacturers fear today. That competition is no idle dream is revealed by cold statistics indicating that per capita lumber consumption has decreased during the past thirty years by more than half, despite an actual net gain in building expansion during the same period. Research and technical developments by other industries have forced wood to retreat or completely abandon many fields it once held. A few of these new materials include fiberboard boxes, composition shingles, steel and plastics in automobile bodies, metal lath, mineral sheathing and insulating materials, metal and plastic interior finishing, aluminum window frames and sash, metal, glass and plastics in furniture, composition flooring, and steel and cement in buildings. Comparison of the production or consumption curves of these and other items made from wood with the same items made from other raw materials will, in most cases, reveal losses by wood.

The competitors of wood are spending hundreds of thousands of dollars to strengthen their foothold in the building field. Examples include: all-steel prefabricated houses, plastic interior finishes on metal which imitate wood, metal

[1]Since submitting this article, the author has become Professor of Forest Chemistry, New York State College of Forestry.

doors, sash and frames, and plastics and metal furniture and paneling. The steel and plastics industries are very energetic and are groping for expansion—primarily at the expense of wood. An article in the March 1937 issue of *Modern Plastics* states that wood is plastics' last adversary and the one remaining problem of the plastics industry is the subjugation of the tree. It is pointed out that but two obstacles remain before the plastics promulgators can conquer the housing and furniture field: namely, the production of a resin of low specific gravity and cost. This author predicts that frame dwellings would soon be as obsolete as the horse and buggy if research halves the production costs of the present type of resins. He may be overenthusiastic, but the statement is nevertheless indicative of the trends and is a challenge.

3. Does the lumber industry know of and can it advise the best uses and treatment of its products? Not altogether. Less research has been done on adapting lumber to its best uses in relation to its grade, size, species, and properties than on most other building materials. The lumber industry should be able to advise the consumer how most effectively to use his material with respect to paints, stains, varnishes, gluing, joining, and all manner of construction.

4. Can further improvement be made in the present products of the lumber industry? Yes, by careful standardization of the product with respect to length and size, so that each piece is identical, by closer control of moisture, by a better knowledge and control of the seasoning process, by eliminating pitch, by reducing shrinkage and swelling, and by making wood fire-resistant. In a number of instances the industry has already taken steps towards these improvements.

5. Is the present disposal and utilization of waste satisfactory? No. A large percentage of the raw material brought to the mill and handled is wasted, resulting in great cost to the manufacturer. During the past twenty years or so, considerable advance has been made in waste reduction by improved milling and in waste utilization for fuel. Little or nothing has been done with logging waste. Waste still remains as one of the large problems of the industry. The economic use of waste must be based on a practical commercial process of manufacture, suitable markets for the product, and an adequate supply of the proper type of waste collected at low unit cost.

6. Can nothing further be done with western red cedar, hemlock, white fir, and other secondary lumber species which are often unprofitable to mill? Undoubtedly there can be. This is a problem allied to the utilization of waste and the development of new products. The availability of Douglas fir and pines has resulted in a lack of attention to the development of suitable uses for these other species and to the overcoming of some of their milling, seasoning, and constructional use problems. Consideration of uses other than as timbers and lumber have hardly been touched upon.

7. Should the lumber industry cling only to its traditional function of sawing and planing boards? Not at all, if by so doing it can increase its efficiency and profits. Clinging to this ancient tradition has so far led to continual retrenchment. The lumber industry is in an excellent position to direct the flow of its forest raw materials into the most suitable channels for various products, increasing greatly the efficiency of production. Diverse products would mean a more stable structure. Control of other products from wood by the lumber industry would enable better adjustment to new developments, reduce competition with outside interests, and bring greater profits.

If it is agreed, then, that there are important problems facing the lumber industry, how may they be met? An intensive program of research should go a long way towards solving these problems.

## Does Research Pay and What Can Research Do With Wood?

That research pays is evident by the multitude of new products, new processes, and new industries developed, not by accidental discovery, but by laborious, long, systematic exploration. The experience of most great industries has led to a dependence upon the research division so that it has become a basic fundamental part of the organization. The steel and associated industries spend hundreds of thousands of dollars in improving the properties of their products and extending their uses. Steel prefabricated houses are but one resultant threat to the lumber industry. Research has developed and is continuing to expand the various fiberboards, waterproof bonded plywood and plastics in all manner of uses. Plastics have been made into furniture and interior veneer finishes on mineral composition and metal bases. One large company has done

extensive research in successfully developing a substitute for wood in the form of a fireproof sheet material for walls. It is used as an outer surface over an interior steel structure.

Companies which maintain or increase their research activities during periods of depression are often well rewarded by direct advantages. The Canadian nickel industry is an example. With business at a standstill after the war, it undertook a vigorous research and development program which brought it back stronger than ever.

What research can do for other materials and other industries it can undoubtedly do for wood. We are not without examples, a few including the simple process for treating lumber to prevent blue-stain, the successful process developed by the Western Pine Association for the preservative treatment of exterior millwork, sugar and alcohol from waste wood in Germany, laminated beams and timbers, timber connectors resulting in a much greater efficiency of construction, lighter and stronger box construction, producer gas from wood for power, insulating fiber from redwood bark, and a wood plastic.

There are also many developments in the laboratory stage which offer excellent possibilities for commercial production. Some of these include bonded synthetic boards for containers and other uses, impregnation of lumber to prevent shrinkage and swelling, and various wood plastics.

### Considerations for a Research Program

Research is a slow process involving an investment over a period of years. However, given the required facilities, the necessary cooperation and the proper direction, the returns are usually high. Research is not a luxury, yet it is not a panacea for all ills, nor an Aladdin's Lamp. Properly organized, equipped, and directed, it is a sound investment.

The inauguration of a research program should be preceded by careful thought and study, each individual project should be critically analyzed and a thorough survey should be made covering all possible factors, including the following:

(a) Technical problems dealing with present products and processes.

(b) Types and amounts of raw materials (wastes, species, etc.) which may be made available at low unit cost for the manufacture of products other than lumber.

(c) Survey of the possible practical application of research data known and reported in the literature.

(d) Possible new products and processes (as yet undeveloped) which might particularly well fit the local conditions for manufacture.

(e) Actual and potential markets for new products.

(f) Careful estimates of probable costs and returns.

The research program may be carried out in adequate laboratories maintained by the industry. Such laboratories may be organized by individual companies or by associations of lumber companies. In the latter plan, the work is available to all the member companies.

If a lumber company or association prefers not to establish a laboratory because of the investment and operating costs, and the availability of suitable facilities elsewhere, it may set aside funds for research projects to be carried out at selected research institutions, universities, and government laboratories. Selection of the research agency should be made on the basis of the facilities available for the particular work in mind, the experience of the personnel in the field of work, and the time which it may devote to directing or carrying out the work. The nature of the problem, whether patents are involved, and other questions should be considered in the choice of a research agency. In all cases a close cooperation should be maintained between the industry and the research agency.

Time is often an unpredictable element in research. It is generally considered that an average of seven years is covered in the development of a process from the laboratory to industrial actuality. Between the laboratory and the plant is the semiplant scale of research which is often of equal importance to the laboratory stage. It is this phase of the research which largely determines the practicality of a process and whether or not it may become profitable.

The pursuit of an intelligent research program by the lumber industry should enable it to recoup some of its past losses and to improve the position of wood as an industrial raw material.

# VALUATION OF NATIONAL FOREST LANDS

By PHILIP NEFF
*U. S. Forest Service*

It is difficult to determine the value of young forest growth and no general agreement seems to have been reached on the best method for this. Mr. Neff discusses three court cases which upheld the reforestation or replacement cost theory for computing the damage to young growth or other forest cover not of commercial or merchantable size or character. These cases, and especially the decisions reached by the courts, are of outstanding interest to all foresters, however employed.

IN RECENT years the federal court decisions have established definite methods of arriving at the valuation of government-owned forest lands and the products thereon. The decisions in four cases are highly important to all foresters generally, to the U. S. Forest Service, and to all those who use or come in contact with the national forests. These cases were: United States vs. Feather River Lumber Company in 1928, 23 F. (2d) 936; United States vs. Spokane International Railway Company, 72 F. (2d) 440; and the United States vs. Blackwell Lumber Company, and United States vs. C. M. St. P. & P. Railway Company, unreported.

The first decision was in 1928, by the United States District Court for the Northern District of California; the others were by the Idaho District Court in 1933 and 1936. Two of them—United States vs. Feather River Lumber Company, and United States vs. Spokane International Railway—were appealed to the Circuit Court of Appeals, Ninth Circuit, where the decisions of the trial courts were upheld. These decisions set forth, and the judges of the Circuit Court of Appeals upheld, the theory of "the reforestation or replacement cost" as the proper basis for computing damage to young growth and other forest cover not of commercial or merchantable size or character. They also adhered to the rule that the value of timber of merchantable size and character must be ascertained by showing the market value.

Heretofore, authorities on forest valuation have given little weight to the theory of cost of restoration as a measure of value or damage. Chapman says of it: "Cost of restoration, while frequently ruled out, is admitted when shown to be less than value, or when value is difficult to determine." And again, "Cost is an individual outlay; value is the product of social conditions. The objections to the use of cost of replacement as a measure of damages are that it does not represent the true value of the property, nor measure the loss. Its use is clearly a makeshift." Teufman says: "The method of cost value is pure fiction—has no real economic basis."

From a private economic standpoint, what they say is still sound. But, from the now more widely recognized standpoint of social economics, it seems clear that the method is reasonable for arriving at the value of forest property of the government, i.e., of all the people. It gives recognition to the fact that the government has entered into the practice of forestry, not only to grow timber, but also to protect the watersheds and the soil thereon. This is essential to insure regulated and unpolluted waterflow for domestic and municipal use, for irrigation, for power, and for navigation. Therefore, a ground cover of brush, chaparral, grass, or reproduction, although of no recognized commercial value, may be of vital importance to the welfare of the public.

Furthermore, national forest lands are set aside and dedicated to public use, and under existing law cannot be sold; neither, from the standpoint of the public interest, can they be dropped from management and protection when damaged or denuded. In the Feather River case the court said: "The government is entitled to recover for the damage arising out of the destruction of young growth. The difference in the market value of the land before and after the fire is not available as a measure, since the national forest is not marketable. Reforestation cost is the proper basis for computing the loss." On appeal of this case, the Circuit Court of Appeals affirmed that principle, saying: "As to young growth, while the measure of damages in such a case is ordinarily the difference in the value of the land before and after the fire, here, there being no law to authorize the sale of the lands injured by the fire, the trial court admitted such evidence as was available to show the damage actually sustained, that is to say, what was required to

make the government whole, and this we think, might properly include the cost of restoring the land to the condition in which it was before the fire."

In all three cases before the Idaho court evidence was offered by the defense to show the commercial or probable sales value of such lands as were burned. This was excluded. Also, evidence was offered by the defense to try to prove that the reproduction would never have any commercial value, due to species, or location, or both. This was also excluded, as was testimony offered to show the price the Forest Service paid for comparable lands in exchanges.

Upon appeal of the Spokane International case, the circuit court held: "Plaintiff's testimony that the fire had destroyed a certain number of acres of immature timber was properly admitted, and the defendant's offer to prove that such timber had no value, properly rejected on the theory that the cost of restoring the land on which the growth had no market value, was the correct measure of damages."

In the case of the United States vs. Chicago, Milwaukee, St. Paul & Pacific Railway Company in December 1936, Idaho District Court, the court instructed the jury that the measure of damages to immature growth was the cost of reproducing the same or reforesting the burned area. In this case there was no commercial timber involved, yet the jury apparently allowed the full amount of damages claimed for the destruction of reproduction and other cover. On the other hand, the claim for fire-suppression costs apparently was materially cut.

The burned area in question in this case consisted of 15,794 acres on the St. Joe National Forest. Most of the acreage had been previously burned by the great fires of 1910. Some of it had been planted, and some had natural reproduction of pine, fir, and other species. For the most part, however, the area was still not in a satisfactory state of reproduction.

For planted areas and areas considered necessary to plant, claim was made for the cost of planting, including cost of stock, plus the cost of protection, with interest at three percent for a period equal to the age of the stand destroyed. For areas that were expected to regenerate themselves naturally, claim was made for protection only, with similar provisions for interest. On such naturally regenerated areas there were 16, 17, and 40-year old saplings and poles.

A major part of the area was classed as a brush type. On this the damage was set at the amount necessary to restore the area to a condition comparable with what it was before the fire, for the purpose of soil and watershed protection. This amounted to the cost of protection plus three percent interest for three years. No definite erosion or other damage was shown.

As stated previously, all of the foregoing was allowed by the court and jury after having been most competently and vigorously opposed by the defense in each case.

It was necessary to call in experts with long and broad experience to support each item. For instance, in the matter of proving the necessity for planting or otherwise, and the cost of planting and planting stock, the testimony of one and sometimes several planting specialists was produced.

Old rule-of-thumb methods, as for instance those used by "old-timer" cruisers in timber estimating, did not stand up as compared to more scientific sampling methods, even though the latter were on a less intensive basis. One may derive a fair idea of the thoroughness necessary in preparation, the size of the job, and the strength of opposition, when it is realized that none of the four cases was tried in less than six days (one taking ten days), and that the number of attorneys involved ranged from six to nine.

All these cases were jury trials, and the jurors in the Idaho cases were predominantly farmers or stump ranchers and small business men. Furthermore, in the Idaho cases the damage claim was principally for young growth, and not commercial timber. Wherever commercial timber was involved, a standard Forest Service appraisal, including the sales price of comparable timber, was used as a base for damage claim.

It should also be noted that the amount claimed and allowed as damages or cost value was the "aft" amount; that is to say, the total amount of expenditures necessary over a future period of years for seedlings, labor, and protection, plus compound interest thereon. It might be argued that the damage was only that amount necessary to produce the "aft" value, or, in other words, the capital value or present worth of the cost of replacement.

I think that argument is untenable in such a damage case. Rather than a sum which at an assumed interest rate would make him whole at

some future time, the injured party is entitled to the value of the thing damaged at the time of the damage.

Obviously the time element is a very important factor in making such appraisals, and it must be well supported as to necessity and practicability. In two of the Idaho cases a natural regeneration period of ten years for white and ponderosa pine was arrived at, and easily supported as reasonable. In arriving at the time necessary to restore the area, this regeneration period was added to the age of the stand destroyed.

Protection costs were based on recent five-year averages for the forest which included the areas burned. Broader average costs are objectionable. Costs for smaller and more comparable areas than the entire forest—although better—are generally not available. The costs of administration should also be included. They, and all other costs claimed, must be proved by competent witnesses who of their own knowledge know of the facts to which they testify.

Fire-protection costs were nine to ten cents per acre for the three Idaho areas—two on the St. Joe and one on the Kaniksu National Forest. The damage in the Milwaukee Railway case (the most recent of the four cases) amounted to an average of $1.64 per acre, although no merchantable-sized timber was on the area, and at the time of damage very unsatisfactory reproduction on much of it.

It seems to me that foresters, forest users, soil conservationists, and others may take considerable satisfaction in these decisions, recognizing as they do, real social values in our public forests even though they cannot be commercially defined.

A NEW international Address Book of Plant Taxonomists, Geographers, and Ecologists is being prepared by the Editors of Chronica Botanica and will be issued in the near future in the "New Series of Plant Science Books." The Address Book will not only give the names and addresses of the scientists included, but also their scientific interests, together with a conspectus of current and planned research. As it is not practicable to compile an address book for the whole of plant science, it is hoped that similar address books will be prepared for the other branches of the plant sciences, plant pathology, agronomy, horticulture, and forestry.

The new Address Book will not only provide a conspectus of research workers and projects in pure taxonomy, ecology, geography, and palaeo-botany, but will list also scientists engaged in the systematic, geographic or ecological aspects of agronomy, forestry, horticulture, and pharmacognosy. Its scope will be restricted to professional and amateur scientists actively engaged in research and organizing work. Those with university degrees but not actively engaged in research or scientific work cannot be included in the book.

Questionnaire cards for those who wish to be included can be had free on request by writing to the Editor, Chronica Botanica, P. O. Box 8, Leiden, Holland.

# FORESTRY—ESSENTIAL TO DELTA AGRICULTURE

By M. H. BRUNER

*University of Arkansas*[1]

Timber growing should have a place in diversified soil-use plans. It may offer relief for some of the economic ills that beset the farmer because of decreasing cotton markets and other agricultural ills; gainful employment during slack times; and a profitable crop in a program of wise land use. As a first step an educational program to arouse interest in forestry and to pave the way for more equitable taxation for land handled for timber production is recommended.

ALONG every river of the South lies a strip of land, of varying width, which is subject to flooding unless protected by levees. When fully protected from floodwaters, satisfactorily drained, and cleared of its hardwood timber, this alluvial soil is generally valuable for intensive crop production.

But in spite of the inherent fertility of this alluvial soil. economic conditions of its inhabitants are generally below the average standards of farm living. This seems to result from a system of agriculture which disregards basic principles of diversified farming that could make a real contribution to the farm family welfare.

Farm living standards in this bottomland hardwood area can be materially raised, however, through giving recognition to the extent and value of timberlands in an adjustment of the agricultural system. The Southern Forest Experiment Station shows 13,507,600 acres of southern hardwoods in the Mississippi River Delta Region, and 15,221,100 acres in hardwood bottomlands in areas covered by the Southern Forest Survey, including Arkansas, Louisiana, Mississippi, Alabama, Georgia, Florida, and parts of Texas and South Carolina. In these 8 states, this timberland can have a stabilizing influence upon the general economic welfare if forestry is developed along with a planned program for agriculture.

In the discussion that follows, an analysis is made of the problems associated with forestry in the hardwood bottomlands of the so-called Arkansas Delta. It is believed that the points developed apply more or less generally to similar conditions in other sections of the Southern Region.

## The Arkansas Delta

The Arkansas Delta lies along the Mississippi River in the eastern part of the state. Towards the north, it widens out because of the influence of the St. Frances, Cache, Black, White, and Arkansas rivers, all of which empty into the Mississippi within the state. Twenty counties, with a total land area of 8,734,000[2] acres are included in the region. Drainage follows slowly meandering rivers and streams which flow to the southeast and pass through an area of remarkably uniform relief, seldom varying more than 25 feet.

Foresters generally recognize that the Delta soils afford conditions favorable for growth of native hardwood species. Bond (*1*) points out that an annual growth of 450 board feet per acre is possible from well stocked, second-growth, hardwood timber in the Delta. Considering relative stumpage prices, this indicates a net annual income that compares favorably with that of second-growth loblolly pine (*P. taeda* L.) on average soils on the Coastal Plains. Eldredge (*4*) states that growth possibilities in the Arkansas Delta are inherently great. He shows that in spite of the present understocked conditions of the second-growth stands, the annual increment is between 0.4 and 0.5 of a cord per acre on 87 percent of the total forest area.

But the importance of farm woodlands in a program of planned agriculture for the Delta is not generally recognized. Many landowners view trees as hindering full use of all their land for row crop production. They clear additional land for crops at every opportunity regardless of wise land use or future timber necessary for continuation of successful agriculture. Mississippi County, for example, cleared 84,000 acres during the 1929 to 1934 period. It requires no student of economics to realize that farms and rural communities need timber products of various kinds; yet this simple idea is disregarded with the result

[1]Since writing this article the author has been appointed extension forester for South Carolina with headquarters at Clemson Agricultural College.

[2]All data relating to agriculture of the Arkansas Delta are taken from the U. S. Census of Agriculture for 1935, unless otherwise qualified.

that many farmers are already going 8 miles from their homes for fuelwood.

The Delta presents a picture of a shrinking forest area as a result of conversion to agriculture. This is natural because the Delta is dominantly cropland, and should be developed largely as such; but this program should proceed no further than justified by wise land use and future domestic timber needs.

## Problems Confronting Farm Forestry

This forestry situation seems to arise from several interrelated physical, economic, and social problems which should be recognized in developing a forestry program for the region. Some of these problems are outlined briefly in the following discussion.

*Type of land.*—Because of the general high productivity of virgin cropland, there is the human prejudice against areas taken up by trees. Accordingly, the landowner uses any sort of method to remove timber from his land. In many instances he cuts, burns, or girdles valuable timber left in partly cut stands, because he feels it more important to accomplish cropland development quickly than to take the time to hunt markets for the merchantable trees. In areas within reaching distance of Memphis, Tenn., many landowners give chemical wood stumpage to contractors for removing it from the land. In other words, landowners seem to attach little value to timber as a soil crop.

*Taxes.*—This problem is closely associated with the foregoing one. Because of cash income landowners can earn through cropland, expensive improvements, such as levees and drainage ditches, are made. It is the usual procedure to organize improvement districts according to political or topographic units, issue bonds to cover construction costs, and then retire the bonds by taxes. Improvement districts of one sort or another are found in all 20 Delta counties, while 13 counties are almost completely covered by them.

Frequently, improvement districts are developed at great expense. In many districts, improvement taxes alone are $1 per acre annually; in extreme cases taxes of $3 have been reported. It is significant that the tax is charged against cropland and timberland alike. This assessment places a tax burden upon the forest land not commensurate with its earning capacity, and practically forces the owner to put it into farm crops as rapidly as possible.

*Tenants.*—Seventy-eight percent of the farms in the 20 Delta counties are operated by plantation managers, tenants, and sharecroppers. Generally these classes of operators care little for timber since their whole existence is centered about the cash crop—cotton. This arises naturally from the economic relationship between operator and landowner, because cotton is a cash crop from which each can obtain an easily divided share at the end of every harvest. The crop, therefore, is readily adapted to financing, producing, and sharing. This is not so true with diversified farming or timber growing.

With thoughts directed only to cotton, tenants and sharecroppers usually make no effort to preserve good timber even when cutting for inferior products such as fuelwood. More than a third of these classes of farm operators move to a new location every year. This unstable type of operator naturally depletes the permanent resources of the farm such as timberlands. Indiscriminate fuelwood cutting is responsible for removing the high-quality trees from many timberlands, leaving only inferior, worthless trees to dominate the area. Such timber contributes little to farm income and tempts the landowner to put it into cropland at his first opportunity.

## Opportunities for Farm Forestry in the Delta

With the social, economic, and physical problems, such as were briefly discussed in the foregoing, retarding interest in timber growing, the whole aspect might appear rather discouraging. But when full value of forestry in a planned program of agriculture for the Delta is recognized, these problems become of secondary importance. In this program, forestry should find a place for the following reasons:

*Farm woodlands are important in a program of wise land use.*—Many areas along bayous and sloughs should remain in timber under management. Local farm leaders of the Delta are beginning to realize that every acre on the farm should contribute to the family welfare, and that such areas should become a part of the planned agriculture in the Delta. In a recent summary by Daniels (*2*) of the reports of county planning committees composed of farm leaders, recommendations are made for setting aside 14.6 percent of the Delta farm land area for woodland protected from grazing. This recommendation was based upon land use principles and covered

those areas along bayous and sloughs predisposed to flooding.

*To supply domestic needs.*—There are 97,400 farms in the Delta embracing 1,678,000 acres of timber, or an average of 17[3] acres to the farm. Since the average farm family uses approximately 15 cords of wood each year, this area perhaps could provide permanently for farm needs, if under timber management. But judging from past experience, this will not be the case and one can expect further shrinkage in forest land. This fact lends emphasis to the desirability for an educational program of timber management in the area.

*Increase farm income.*—The financial income from timberland to supplement farm income can be developed into an important economic factor in agriculture of the Delta. The landowner will have to be shown that diversified farming, in which forestry has a share, is one solution to the economic ills which now beset him, resulting from diminishing foreign cotton markets, a carryover of 13,400,000 bales of cotton from previous years, and a 1938 crop of 12,000,000 bales. For cotton farming, the outlook is indeed discouraging.

But the outlook for hardwood timber grown in the Delta presents a different aspect. Water, rail, and road transportation facilities generally make the bulk of timber readily accessible, except during wet seasons. Through these means, it is readily moved to northern and eastern consuming centers.

Steer (*5*) presents an optimistic outlook for hardwood stumpage. He states, "the trend of stumpage prices since 1900, when adjusted to the purchasing power of the dollar, has been distinctly upward in the country as a whole." Steer also suggests that continued demands for hardwood products for interior finish, cooperage, high-grade veneer, and specialties indicate a market that will provide a steady outlet for hardwood stumpage. This outlook lends encouragement to the development of sustained yield for the farm forests of the Delta.

*Increase gainfully employed days on the farm.*—Daniels (*3*) points out that the number of gainfully employed days on the farm during the year has a direct influence on farm income. He shows that the average farmer in Minnesota, for example, is gainfully employed 341 days a year, while the Arkansas farmer is gainfully employed but 175 days. He attributes this largely to diversified farming practiced in Minnesota as contrasted with the one-crop system of Arkansas. He believes that farm income is directly influenced by this factor since Minnesota has an average annual farm income of $1,570 compared to $600 for Arkansas.

This problem might be partially solved through developing forest products industries such as furniture and dimension stock that would provide an outlet for labor during slack periods of farming.

## A Forestry Program for the Delta

Because of the human problems associated with forestry, a program of education offers one solution since general physical features of the Delta augur opportunities for forestry in a planned program of diversified agriculture. The present depleted condition of woodlands results from causes associated with land ownership. This indicates the necessity of carrying an organized program of education to the landowner under the leadership of extension agents of the University of Arkansas College of Agriculture in cooperation with the Forest Service, the state forester, and farm organizations such as the Farm Bureau and Grange. Definite steps should be taken to initiate the program in the near future. Foresters, in general, have overlooked the opportunity for developing woodlands as a permanent supplement to agriculture in the Delta. They are partly to blame, therefore, for the present chaotic woodland situation.

With the county agricultural extension agent's office as a clearing house, the following educational program might be organized:

1. Set up a farm organization forestry committee composed of interested community leaders in each county. This committee will govern the forestry program within the county, suggest the policies, and cooperate with the county agent in carrying the program to individual farmers.

2. The committee will have the responsibility of encouraging the planting of forest trees to provide future farm timber in areas where timber resources are being rapidly depleted.

[3]The farm forest acreage is materially higher than this since, in taking the census data, "each farm operator was asked to report as a unit all the land he considered a part of his farm, but not to include isolated tracts of timberland not connected with his farm."—Bureau of Census.

3. The committee will be responsible for encouraging demonstrations in timber management. Landowners will become acquainted thereby with methods of managing their timber to supply farm needs and to supplement farm income through sale of stumpage.

4. Finally, the committee will be responsible for dissemination of educational material such as posters, leaflets, circulars, and results of demonstrations, in cooperation with the county agent, at farm organization meetings, 4-H clubs, and schools.

This educational program should arouse interest in forestry and pave the way for legislation to provide an equitable tax for timberlands. It should gather impetus as the committees, in all Delta counties, unite in a single purpose to adjust existing tax laws which are retarding the whole program of forestry.

This and associated problems can be solved permanently and equitably by organized effort to place forestry in a permanent program of land use.

Literature Cited

1. Bond, W. E. 1933. The industrial opportunities for private forestry in the South. Southern Lumberman 147 (1865) : 61-62.
2. Daniels, J. B. 1938. Summary county agricultural planning project, Arkansas, 1937. Univ. Ark. Col. Agric. Ext. Serv. Report.
3. ————. 1938. Farm management problems of Arkansas. Univ. Ark. Col. Agric. Ext. Serv. Report.
4. Eldredge, I. F. 1938. Forest resources of the North Arkansas Delta. Southern Forest Exp. Sta. Release 32.
5. Steer, H. B. 1938. Stumpage prices of privately owned timber in the United States. U. S. Dept. Agric. Tech. Bull. 626.

## Tree Planting on Farms Has Doubled Since 1935

FARMERS have more than doubled their tree-planting activities since 1935, according to a report of the U. S. Forest Service. A total of 55,359,728 trees was distributed during the calendar year 1938. Approximately 41,700,000 trees were distributed in 1937, 35,600,000 in 1936, and 26,150,000 in 1935.

The Clarke-McNary Law, passed in 1924, provides for the allotment of federal funds to states matching such appropriations for carrying on fire protection work in forests and for furnishing forest tree seedlings for plantings on farms. Expenditures by the federal government during 1938 in this program were $75,286.33; the states spent $306,910.33 on the cooperative project.

A total distribution of 7,036,000 forest tree seedlings by Georgia gave that state the lead in the nation during 1938, with New York taking second place with distribution of 5,610,000 trees, and Pennsylvania third with 4,347,000. Other states which distributed more than 3,000,000 trees include Arkansas, Florida, South Carolina, Tennessee, and Wisconsin.

# LICENSING OF FORESTERS

## REPORT OF COMMITTEE[1] ON LICENSING OF FORESTERS NEW YORK SECTION

This report of the New York Section's Committee on Licensing of Foresters was presented to the New York Section at its annual winter meeting January 26-27, 1939, in Albany, N. Y. Those present at the meeting voted to take no action on the report until all Section members have had an opportunity to study it, and not to have a bill introduced in the New York State legislature until the Section has given an affirmative majority to the undertaking.

*PURPOSE of study.*—The purpose of this study has been to determine whether it is desirable at this time to recommend to the New York Section, Society of American Foresters, the licensing of the professional foresters in New York State.

*Object of licensure.*—The primary object of licensure is to protect the public against ignorance and incompetence on the part of those who profess to render essential service.

*Historical.*—The system of licensing the learned professions originated in the medieval crafts. During the Middle Ages nearly every specialized occupation was subjected to controls authorized by either church or state. This was eventually abolished because the licensing of masters and compulsory apprenticeship of employees proved not a benefit but a nuisance. Furthermore, the guilds could not be adapted to the changes caused by inventions and the Industrial Revolution.

*Present status.*—Today licensure in this country is a prerogative of the various states. In the state of New York a license is required at the present time for admission to the practice of the following occupations:

| *Professional Group* | *Semiprofessional Group* | *Nonprofessional Group* |
|---|---|---|
| Architecture. | Nursing. | Certified Public Accountant. |
| Dentistry. | Optometry. | Certified Shorthand Reporting. |
| Engineering. | Pharmacy. | Land Surveying. |
| Law (Bar Association). | Pediatry. | |
| Medicine. | | |
| Veterinary Medicine and Surgery. | | |

The educational requirements vary in the different groups. They include as little as four years of high school training (land surveying) and as much as six years of college work (medicine). The practical experience necessary varies from none (optometry) to six years (surveying).

A license issued in another state having equivalent requirements is usually recognized in New York State.

*Oregon.*—The State of Oregon has a law whereby logging or forest engineering is recog nized as a profession requiring the state license in engineering for its practice within the state.

*Washington.*—The State of Washington is also considering the enactment of a law licensing the professional logging or forest engineer.

*Canada.*—In Canada the Provinces of Quebec and New Brunswick have laws providing for the licensing of professional foresters. The Quebec law has been in force for many years, but the New Brunswick law became operative only in April 1938. In each case the law provides for a board of five examiners, of which four members must be foresters. Licensed foresters from other provinces may be registered without formality other than payment of the regular fee provided the province in which they are residents extends a similar privilege to their own registered foresters. For jobs which require special qualifications, the board may also accept non-residents for a period of not more than two years with a fee fixed by the Minister of Lands.

The province of British Columbia recognizes logging or forest engineering in their licensing law for Professional Engineers.

*Germany.*—In Germany under the new forest

[1] R. R. Fenska, *Chairman.*

law all foresters must pass a rigid state examination before they can practice their profession. The German forestry student must complete a prescribed university course and in addition serve one to two years without remuneration as an apprentice gaining practical experience before he is accepted as a professional forester. The law applies to foresters in both private and public employment.

The new law also requires that all forest owners of over 2,500 acres *must* employ a professional forester who must have passed the state examination for foresters.

*Shade tree experts.*—At the present time the states of Connecticut, Rhode Island, New Hampshire, Maine, and Louisiana have state laws requiring that every person who solicits or contracts to do private shade tree work must be duly licensed by a state examining board. They also provide a penalty and legal action against unlicensed individuals or organizations.

*Definition of forestry.*—Forestry means the development of forest areas for the maximum service to mankind. Silviculture is the core around which all other phases of forestry evolve.

The statement is sometimes made that the concept of present day forestry differs from that of 25 years ago. This is hardly based on facts. The earliest definition to be found in print in this country is attributed to Gifford Pinchot (1914) in which he defines forestry as follows:

"Forestry is the common sense way to handle woodlands for what they can bring; it is the art of producing from the forest whatever it can yield for the service of man."

This definition is as good today as it was 25 years ago. It is broad enough to include all the so-called modern trends or phases of forestry, such as wood-utilization, game management, recreation, and soil erosion. Furthermore, in Europe, the cradle of forestry, management plans have included these phases as part of forestry for over a hundred years.

It is all a matter of economics. Even silviculture, when it disagrees with local economic conditions, must give way to economics. Therefore, the degree to which forestry is practiced on an area depends on local economic conditions. The above definition takes this into consideration.

*Professional forester.*—The Administrator of the Federal Fair Labor Standards Act has defined a professional as follows:

"A professional is any employe: (a) Who is customarily and regularly employed in work

"(1) Predominantly intellectual and varied in character as opposed to routine mental, manual, mechanical or physical work, and

"(2) Requiring the consistent exercise of discretion and judgment both as to the manner and time of performance as opposed to work subject to active direction and supervision, and

"(3) Of such a character that the output produced or result accomplished cannot be standardized in relation to a given period of time, and

"(4) Based upon educational training in a specially organized body of knowledge, as distinguished from a general academic education and from an apprenticeship, and from training in the performance of routine mental, manual, mechanical or physical processes in accordance with a previously indicated or standardized formula, plan or procedure, and

"(b) Who does no substantial amount of work of the same nature as that performed by nonexempt employes of the employer."

The above definition when applied to the work of the forester gives us a legal definition of a professional forester.[2]

In Canada the legal definition of a forester is "A person qualified to advise upon or supervise in a professional capacity the execution of work in one or more of the branches of forestry."

*Who is a forester?*—The purpose of forestry education is primarily to provide systematic instruction in forestry and allied subjects. When the fruits of this instruction are put to practical use we have what we know as the professional forester.

There are in this country a variety of "foresters" whose education and experience varies from years of college training and field experience to that of only a few months in practical woods work or as an enrollee in one of the Civilian Conservation Corps camps.

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[2]For immigration purposes, the General Consular Instructions to the American Consulate offices defines a forester, as follows:

"A forester is one who is trained and skilled in the production, protection or utilization of forests. A forester might be a skilled tree planter, but one who plants and cares for shade or ornamental trees is not necessarily a forester who deals with forests rather than with trees. While an ordinary woodchopper would not be considered as coming within this class, an experienced woodsman who knows something of practical logging engineering would be considered as a skilled agricultural laborer."

The question naturally arises as to what stage along this scale of extremes is a man really qualified to merit the designation of a professional forester.

It is the consensus of opinion of the profession that a five-year college training, plus certain additional years in practical experience, is essential to qualify one for the field of the professional forester. This brings it within the requirements of the professions of law, medicine, and engineering, all of which require a license for their practice in the State of New York, and all other states and countries.

Mere membership in the Society of American Foresters does not by itself qualify a person to the designation of professional forester in the opinion of most men in the profession. The reason is that the qualifications for the initial grade (Junior member) are based on the acquisition of theoretical training in the fundamental principles of professional forestry. For this grade, practical or field training is not required. If the candidate is a graduate of a school of forestry approved by the Council, he is accepted on the sponsorship of three members, in absence of protests after publication of his name.

In regard to the so-called practical forester who has obtained his experience chiefly in the "university of hard knocks" it is our attitude, as well as that of the Society, that such an individual is not a professional forester unless he merits the educational qualifications set forth in the Constitution and By-laws of the Society issued in July 1938. These require that he have an adequate understanding of the basic economic, business and technical facts and principles sufficient for the foundation of a professional career in forestry and substantially equivalent to the training given in a school of forestry approved by the Council.

At the present time each institution sets up its own special curricula for forestry education as it desires and is the sole judge of their adequacy for the professional training of a forester. Until our Society takes steps to set up a uniform educational standard for the professional forester through a state licensing board we may continue to have a certain number of foresters with inadequate basic knowledge of the profession. The Council of the Society seems to be unable to formulate any minimum standards of professional instruction due to the variables that enter into the problem. For instance, when specialized curricula fail to show even a minimum of general forestry, defendants are not lacking to point out the fact that such subjects are an indispensable part of forestry. Yet graduates from these same specialized courses themselves have frequently bemoaned their lack of basic training in silviculture after they have been out of school only a short time.

*Foresters in private employment.*—A study of the membership of the New York Section shows that there are at the present time (1938) approximately 200 foresters employed in this state in forestry and allied fields. Out of this number 75 percent are in public service, and 25 percent in private employment. In this latter group are 18 who are engaged in a phase of forestry which would require a license if such a law were now in force.

There is, however, a definite trend at the present time for more foresters to seek private employment. This is due to the remote possibility that opportunities in federal employment are likely to increase in the immediate future. That private employment is increasing is indicated by a study of the employment of graduates of five forestry schools[3] for 1937 which shows that 11 men were in the federal forest service, 3 in state work, 27 with private companies, and 31 not in forestry or unemployed.

The graduates from the New York State College of Forestry for the same year showed a similar trend. Of the 93 graduates in 1937, 10 percent were absorbed by the federal government, 2 percent by the state, 42 percent by private agencies, 35 percent unemployed or in non-forestry business, and 11 percent in graduate work.[4]

Also, there is the possibility that some type of public regulation for the management of private forest land may be enacted in the not distant future. Should such be the case the employment of foresters by private concerns would undoubtedly increase.

If a licensing law should be passed by the state legislature the 18 men now engaged in private forestry work in New York State would receive their licenses, without examination, through the so-called "grandfather clause" based on the 14th Amendment of the Constitution of the United

[3]Yale, Harvard, Maine, New Hampshire, and Connecticut.

[4]From "Report of the Committee on Employment," New England Section, J. D. Curtis, Chairman, March 3, 1938. Published in S. A. F. Affairs, April 1938.

States which in part provides that "no state shall make or enforce any law which shall abridge the privileges or immunities of citizens of the United States; nor shall any state deprive any person of life, liberty or property, without due process of law; nor deny to any person within its jurisdiction the equal protection of the laws."

The effect of this Amendment is to prevent any state from making laws which take away any of the rights of a citizen of that state without due process of law. By due process of law is meant that method of procedure usually followed in giving the general public of any particular state notice that the rights of the citizens of that state are to be restricted and affording the general public and the persons whose rights are to be restricted an opportunity to be heard on the question why those rights should not be abridged or confined or restricted.

*Regulating pursuit of occupations.*—The reasonable regulation by states and municipalities of various occupations and professions is not contrary to this amendment in so far as it does not operate to deprive one of his property without due process of law.

Licensing statutes, whether applied to professional or other occupations are, in a sense, public regulations of those professions and occupations, but today they are usually applied in only two directions.

(a) In the first instance, to make reasonably certain that the public obtains qualified persons to conduct the work involved in professional activities or trained occupations, and

(b) To take away this privilege for cause.

The meaning of the word "property rights" is not confined to tangible visible property whether it be land or personal property. We have a broader concept of this idea which extends to the right of labor. The right to work in any calling is a property right of which a person cannot be deprived by simple mandate of the legislature.

In the forestry profession today there is no restriction upon any person to undertake to do professional forestry work in and among the general public. Of course informed persons will be careful to obtain trained and qualified persons only, to undertake work requiring professional training. However, the general public is not so informed, and speaking both practically and legally there is nothing to prevent any person from reading one or two books on forestry and holding himself out to the general public thereafter as being able to advise on forestry matters competently.

Licensing laws seek to make reasonably certain that such persons do not have this opportunity to harm the general public. However, before this right to do forestry work of a professional character can be restricted to persons who meet reasonable standards both as to training and character, it is this general public who must be given notice that this right will be restricted and who must be afforded an opportunity to be heard on that subject. After such notice and such opportunity is given, no objections to licensing laws can thereafter be heard at least upon the ground that the general public did not know that these laws were about to be passed.

The use of the "grandfather clause" in professional licensing laws applies to that class of persons in the general public who either (1) were practicing that profession or occupation when the licensing laws went into effect, or (2) who claim that they have had that right after these laws were passed. All persons in these two categories therefore are in a position where the licensing laws cannot deprive them of the right to follow that vocation as long as they live. The length of time that it takes for these persons to disappear from the scenery after the licensing of any vocation usually takes the span of a lifetime, and in this we find the origin of the term "grandfather clause." If a licensing law were to be passed today applicable to any occupation or profession it would be very likely that it would be on the statute books for the span of a grandfather's time, which may be from 70 to 80 years before all persons who claim they have a right to follow that vocation, at the time that the licensing law was enacted, would be completely eliminated.

A law requiring the licensing of a profession usually sets up some method or machinery that guarantees to the public generally some minimum standard of professional ability, before the privilege of licensing is granted to the applicant. This usually contemplates examination. However, we cannot require persons already engaged in that profession to take those examinations in order for them to continue in that profession, but we can require them to register each year in order to continue and sustain this professional status. Examination of the licensing laws of other professions will be found to contain words to

the effect that persons engaged in that occupation may obtain their license by registration, that said laws apply only to persons who attempt to enter that occupation after that law is passed; and furthermore, the laws usually also contain some time limitation, usually one to two or three years, within which all persons then engaged in that occupation must register. The notice to the general public and the opportunity to those interested are given by the actual passage of the law and before the legislature or its committee.

It would seem an opportune time to place a licensing law on our statute books now, if we are ever going to do so. In future years when incompetent "foresters" might secure their license through the "grandfather clause" the best interests of the profession would suffer correspondingly.

*Need for licensing foresters.*—The private employer has no means of determining competence among foresters today. He does not know when or if he is getting expert technical service. For instance, there is now in existence a firm of consulting foresters made up of a partnership, neither one of whom is a qualified practitioner. Both men, however, are extremely successful business men and apparently they are giving their customers what they want. Whether the customers are getting what they need is an open question.

That men who employ private foresters would have confidence in the licensed forester is shown by the following case:

A banking firm wanted to float a bond issue for a wood-using industry in one of the New England states. The value of the timber owned by the company was a large item as security for the bond issue. The wood-using company had an appraisal made of the timberland by a local "timber-cruiser." The banking firm, however, wanted to check this appraisal with an independent cruise and appraisal by a forester. But where could they secure a competent forester the board of directors asked. The state forester finally approved a certain forester as competent to make such an appraisal and issued a special certificate to this forester. The bonding house accepted his appraisal and issued the bonds. Here was the fore-runner of the licensing of the professional foresters by the states in this country.

Licensing, furthermore, would give the profession a higher rating with the general public than it now has. The present standing of the forester in the eyes of some people is well illustrated by the following case:

A recent announcement for a competitive examination for the position of forester in the Department of Correction stated as the duties of the forester, "To supervise planting, cutting and milling forest products, etc." He was also to act as guard and a very rigid physical examination was required. The applicant had to have at least one year of college training in forestry. The salary was $1,600 per year.

Applicants for the position of prison guards were required to have only a high school education but their initial salary was $1,800 per year. Thus the forester had to accept a lower salary on account of his forestry training.

The need in this country for uniformity of forestry school standards as to training of foresters can be accomplished in a large measure through the requirements of a state license. The Society of American Foresters alone has been unable to make any progress along this line.

The stronger schools have shown the greater tendency to branch out, adding specialized curricula devoted almost exclusively to some branch of land management, such as recreation, game or grazing, or concentration on phases of utilization to the exclusion of other branches of forestry. While all these subjects and their practice are within the realm of the profession when they tie in directly with forestry, one who specializes in these subjects should first acquire a sound basic training as a forester.

Without some agreement on the existence of a common professional body of knowledge, forestry becomes, instead of a profession, a loosely bound aggregation of miscellaneous subjects based on the one hand on land management for everything but agriculture, and on the other, including as specialties all forms of utilization of forest products irrespective of land management.

If the requirements for licensing of foresters specified as a minimum a five-year course in a school of forestry the foregoing conditions would not be difficult of solution. A five-year course would give the necessary time for an adequate forestry base.

*Forest ranger.*—The work of the forest ranger is chiefly of a vocational nature rather than of the professional type. He usually works under the direction of a forester, or follows more or less routine work based on an established policy. Therefore, it is the opinion of the committee

that there is no real need for the licensing of the forest ranger.

Furthermore, the practical nature of the work of the forest ranger is an excellent proving ground for the forestry graduate just out of college. This field should be one of those left open to him for experience to qualify for the license of a professional forester.

*Obstacles to licensure.*—While there are no real disadvantages to the licensing of foresters there are obstacles in the way of this requirement.

(1) It will be difficult to define the field of activity within which only licensed foresters might operate. Obviously licenses could not be required of foresters engaged in work for which men are also trained in other than forestry schools. For example, licenses would probably not be required in most branches of utilization since pulp and paper chemists, technicians, logging superintendents, saw mill operators, and lumber salesmen need not necessarily be foresters. Neither would licenses be required of men engaged in the tree nursery business, or game management as such. In fact such men should not be able to qualify for a forester's license unless they also had a general forestry training.

(2) There is no public demand for licensing of foresters.

*Advantages of the licensing of foresters.*—(1) In the absence of a licensing system the forestry profession is at the mercy of charlatans in private fields and of politicians in public employment.

(2) Licensing would be a step towards the creation of a forestry profession based on a body of common professional knowledge.

(3) Licensing would eliminate the free appropriation of the term forester by men almost entirely devoid of professional qualifications. Such men even seek membership in the Society of American Foresters as proof of their professional status. In some instances they have even used political pressure to secure endorsement by professional subordinates for this advancement.

(4) It would give the profession the protection of the public against individuals who endeavor, without proper qualifications, to capitalize upon the reputation for expert knowledge and reliability which alone justifies the existence of professions.

(5) Through a licensing board the requirements for the professional forester can be maintained on a uniformly high standard through the requirements of five years of college training plus a certain number of years of actual experience as the basis for the license of the forester.

(6) Licensing would help place forestry on a par with the other professions such as medicine, law, and engineering.

It is the next important step in the establishment of forestry on a professional basis in the states.

## New Hybrid Varieties of Poplar

MORE than 2,000 new hybrid varieties of poplar trees have been produced within the past two years by the Dominion Forest Service in collaboration with the Department of Agriculture and the National Research Council of Canada. This work is being carried on in the laboratories and greenhouses of the Research Council and the greenhouses at the Central Experimental Farm in Ottawa, and in the nurseries at the Petawawa Forest Experiment Station, Chalk River, Ontario. The object of this extensive forest tree breeding program is to produce rapid-growing and disease-resistant varieties of poplars suitable for pulp and match stock, and drought-resisting varieties for shelterbelt planting in the prairie sections of western Canada.

About 1,500 varieties are primarily designed for testing as shelterbelt trees in the Prairie Provinces. Trees for this purpose must be resistant to drought, frost, and wind, and to furnish these characteristics the native aspens found in the vicinity of Calgary are used. Branches of these trees are shipped to Ottawa during the winter months when the male flowers are dormant, and the pollen is dusted on to flowering branches of the different hybrid and other varieties of poplar available at the Central Experimental Farm. Approximately 200 natural poplar hybrids have already been identified in the vicinity of Ottawa.

# THE LICENSING OF FORESTERS: A COMMENT

By JULIUS KAHN

In his article "Licensing of Foresters" in the February JOURNAL, John Sammi took exception to some of the arguments in favor of state licensure. The author of the following article, who is a lawyer as well as a professionally trained forester, disagrees with some of Professor Sammi's conclusions.

IN the JOURNAL OF FORESTRY for February 1939, the article "Licensing of Foresters" by John Sammi contains so many errors and misstatements that corrections are necessary. As far as possible, I will follow his article, subject by subject.

## WHAT IS LICENSING?

The word "license" usually is associated with the meaning of privilege. It refers to authority to do or omit an act, which authority may be granted by a political body, a private corporation, or person, or without any authority other than the mere assertion of right or privilege, affirmatively or negatively. As applied to licensing of the professions, it means the grant of authority by a political body, to persons disciplined in specialized fields of activity, which authority is withheld from persons not so disciplined. Oftimes, nonprofessional callings are also licensed, but in this class of occupations the word usually used is "permit." These permits are usually granted by political subdivisions of the state. The state does not license plumbers, electricians, and barbers. The political subdivisions of a state have certain varying laws concerning buildings and construction, and, to make reasonably certain that buildings conform to law, they require that the work be done by persons who are charged to see to it that such will be the case, on pain of losing their "permits" to do such work in the future.

When the general hygienic laws of the state touch on the occupation of persons engaged in certain work, the state has imposed licensure of such persons. The work of the embalmer and undertaker is an example of such calling and is licensed by the state, not under its educational law, but usually under the general powers of the health department.

The licensing of peddlers and prostitutes, when done, is not strictly a license. In that respect, the use of the word "license" simply indicates the liberty which we take with the English language with the ordinary meaning of the word. Such procedure is simply local police control over vagrancies.

For general economic purposes, the definitions of licensing by Jensen and Wyand may be acceptable, but as confined to the sphere of professional licensing they do not suffice. The basic idea in professional licensing is to assure reasonably that the general public shall have recourse to adequately prepared and responsible men in callings affected with a public interest. The emphasis is on the character and the preparation of these men rather than upon the regulation of the particular professional activity.

## BY WHAT AGENCIES ARE LICENSES GRANTED?

The federal government does not have the power to grant licenses to professional callings. In that respect, it holds no importance whatsoever. The several sovereign states of our union have not delegated to the central government the power to regulate education. This power has been reserved by our several states, which exercise same fully, even extending into the field of professional licensing. The federal government under its constitution, can regulate interstate commerce, but this is far afield from licensing a calling or a profession.

Business men do grant licenses for the sale of patented articles, territorial rights for the sale of an infinite variety of products, but in this respect, the word "license" has no significance to any meaning of professional licensing.

## JUSTIFICATION

I find no sympathy with the suggestion of Jensen to the effect that licensing prevents a profession from degrading into a nuisance. Our professions reached lofty heights, rendered great public service, and gained the esteem of the public before they became licensed callings. It is more likely true that even without licensure, these professions would have continued in their preordained destinations. Licensure became

necessary due to the growth in population, activity, and territory, as a result of which the average man could no longer ascertain for himself who the responsible practitioner was and turned to society for the answer, namely licensure. Licensure also became necessary for a profession to assume a larger scope and responsibility in the direction of public affairs in that it was the legal method by which such profession entered into an understandable and responsible relationship with the state.

The pressure for licensing may be external or internal. Essentially, it is the same thing, because the need for licensure is apparent however the same may be exerted. While professional licensure tends to make available reliable men and service, these, in and of themselves, do not justify licensure. When we speak of a profession, it is well to bear in mind a concept of an organized group, possessed of learning, possessed of a spirit of public service, possessed of the thought of truth in that service. The further assurance of a livelihood obtainable by virtue of licensing is not a professional consideration justifying such licensure. In fact, the professional spirit constantly curbs the urges of that incident.

It is, then, in the opportunity for a profession to enlarge its horizon, to grow intellectually, to create a comradeship in a certain field, to be of greater public service, and to enter into a clarified relationship with the general public, that the justifications for licensure will be found.

The forestry profession is concerned with making a proper use of land constituting approximately two-thirds of the land area of the United States, and, in the case of the State of New York, one-half of her land area. The problems interwoven into this work are of first interest and importance to the state and of growing public interest. Is it unreasonable to suggest that a body of men trained to do this work shall be so organized that for the results of their work of today the responsibility shall be borne by the profession in the future? Or shall the state and public not have a body of men responsible for long-time forestry programs? Or shall we continue to leave large sections of forestry activities, professional in nature, to nonforesters, and nevertheless be charged for the results? Perhaps licensure of doctors and lawyers because of immediate urgent considerations, is of more importance than licensure of professional foresters, who can plan, and use the Ohio Valley so as to reduce floods? Or would this not also be an urgent immediate consideration?

Authority is cited that licensure is, in fact, a tax on the theory, perhaps, "that a rose by any other name smells just as sweet." However, Willard E. Atkins, in his *Economics of Modern Life*, Van Rees Press, New York, 1939, cites at page 299 as follows:

"At one time, the fee system was of major importance in governmental business. The use of fees does not occupy large space in our modern revenue systems."

It is but reasonable that the licensing authority reimburse itself for the cost of carrying on this service to the profession and to the public, and to that extent it should not be classified as a tax. Of the several professions in the State of New York for which fees are exacted for the taking of the required examinations and for the annual registrations, the cost is expected to be borne by the examinees, but information leads me to believe that the general fund must make up to some extent the deficiencies occasioned in the operation of these licensing agencies. This is justified in the public interest which obtains the benefit of such licensed men. There is no support then to the contention that the licensing of foresters is a tax measure, hidden or otherwise. It may be of interest to note that the fees for taking examinations in the State of New York vary from $10 in the case of pharmacist to $25 in the case of engineer.

### Licenses as Applied to Foresters

To some extent, I have already discussed the limitation on the federal government to undertake the licensing of professional foresters. However desirable it would be that the federal government undertake to do this work, we cannot expect fundamental changes in our system of government, merely to suit the interest of the forestry profession. It is much more sensible to try to fit ourselves into the present scheme of things. The question of whether licensing of professional foresters is necessary in the general public welfare is inevitably bound up with the question of what shall we do with our natural resources and our great land areas. The fact that the federal government employs professional foresters in its own service, through civil service examinations, is no suggestion that licensing should not be encouraged. The federal government and the state government today do not em-

ploy or admit to civil service examinations men from other licensed professions unless they can show that they have been licensed in that calling by some state.

With reference to the public demand for licensing of foresters, it is true that no campaign for such has taken place in public, but it is to be questioned whether any profession became licensed by virtue of public demand for such. What is probably true is that the thoughtful persons in any professional calling realized the necessity for such act, not as a solution of all possible problems with which such occupation is confronted, but possibly as the best available remedy to undertake to do the work of that profession with full public responsibility and recognition. Public attention has been focused upon the field of forestry for at least fifty years in the United States, and it is unreasonable to assume that this interest is trained only on the fields and the woods and not upon the men therein engaged.

The objection is raised to the licensing of the forestry profession by the state. At this time, we should not engage in theories of government, but should be concerned with the situation as it exists today. The licensing of professional callings is part of the educational function of a state, and if done must be done by the several states of our union. The situation in Canada seems to indicate that foresters from other provinces of Canada and even from the United States have difficulty in procuring licenses to practice professional forestry in the province of Quebec. This does not tell the whole story. Apparently, there seems to be an interchange of such privileges between all the provinces of Canada except Quebec and perhaps from Quebec to the other provinces. The peculiar situation whereby this condition exists seems to be part of the historic background whereby Quebec and the remainder of Canada became the Dominion that it is today. It, no doubt, is true, but is perhaps unfortunate and will in time subside.

However, in the United States of America this condition does not exist. There is reciprocity between the forty-eight states of our union in connection with the recognition of the licenses granted in one state by a sister state. In New York every one of the laws licensing professions provides for the issuance of licenses to practitioners from other states, upon the submission to this state of satisfactory evidence that the requirements for the issuance of such license by the person requesting same were substantially the equivalent of the requirements in force in this state when such license was issued. Of course, each of the forty-eight states can set up reasonable requirements for the professional standards of its professional men, but, once those standards are set up, any other person from anv other part of the United States, complying with these standards, has the right, guaranteed by our federal constitution, to obtain a license in his calling.

For instance, the State of Arizona may license professional foresters after one year's study and three months' experience, whereas the State of New York may require a four-year course of study. The standards of the State of New York, will, of course, be higher than those required by the State of Arizona. Presumably, a citizen from the State of New York will have no difficulty in complying with the regulations of the State of Arizona, but a citizen from the State of Arizona may have difficulty in complying with the regulations of the State of New York. This does not offend the federal constitution, wherein the several states agreed not to violate the rights and immunities of the citizens of the several states in our union. It is a situation entirely dissimilar to that described as existing between the Province of Quebec and other provinces in the Dominion of Canada.

The suggestion that the Society of American Foresters be constituted as the agency for licensing of professional foresters, may, at first glance, sound logical. However, from the thesis so far developed, it would appear that no competent authority exists in the federal government to con fer any such power on our Society, and that it is extremely unlikely that forty-eight states would confer such power of the same character and at the same time upon our Society. Furthermore, licensing being a public function, it is hardly likely that any government would delegate this power to a private society such as the Society of American Foresters. The pages of the JOURNAL are replete with the difficulty that the Society has had with enforcing disciplinary rules, and setting up standards of ethics. These powers can only be exercised effectively with the force of government behind them, which unfortunately our Society at this time does not possess.

There then follows a discussion on certain advantages and disadvantages to foresters in connection with licensing their occupation. Licens-

ing will not place forestry on a par with other professions, licensed or otherwise; licensing will but give to the profession the power to regulate itself, enforce its precepts, and assume the responsibility for which today it is chargeable, perhaps unofficially. In these respects, it offers opportunity for growth in service and intellectuality.

### Licensing of Foresters in the State of New York

The committee studying the subject of licensing of foresters in the State of New York has prepared legislation under consideration, which admittedly needs revision. It follows closely the sections of the law under which other professions, and in particular the engineering profession, were licensed. First, it is desirable to have the approval of the principle of licensure by the profession. It would, thereupon, submit a bill for public scrutiny and discussion.

However, certain statements made in the discussion by Professor Sammi need clarification. In the State of New York, no civil service appointments in the licensed professions are made unless the appointees are duly licensed. The bill exempts foresters in the employ of the state until the expiration of the present existing term of office. However under the "grandfather clause" of the bill, such state employees can acquire licensure upon registration without examination. So far as federal employees are concerned a state cannot require an employee of the federal government to hold a license as a condition to work for the federal government in that state, because it would then be infringing upon the activity of the federal government and would, to that extent, be unconstitutional. The federal government today rarely employs professional men from licensed professions unless they first have state licensure. It seems logical to believe that, were the profession of forestry to become a licensed calling, the federal government would require from foresters, as a condition to entering federal work, to hold a state license to practice forestry also.

Licensing would be controlled by the Board of Regents of the University of the State of New York. Its agency to carry out the law licensing foresters would be a board of seven foresters appointed by said regents. This board holds office for five years only and its members are removable for misconduct, incompetency, or neglect of duty.

I am confident that the profession of forestry has seven men who possess ten years of practical experience. No member of the federal government of the State Conservation Department would be precluded from appointment to this board, because it is precisely in this field that such men would be readily obtainable. Another highly responsible source from which to obtain men with ten years of practical experience to staff such a board would be from the faculties of the forestry colleges. My observations of faculty members of at least three forestry colleges lead me to believe that they possess that blend of experience, theory, and understanding of young men to fit them eminently for the post of forestry license board examiner.

The suggestion that licensure is a Machiavellian scheme whereby certain commercial interests seek to dominate and control the forestry profession in New York is rejected as not worthy of consideration, and is in fact not true.

I invite Professor Sammi to scan the list of the gentlemen constituting the examining boards of the several professions. He will find without exception that these boards are manned by the outstanding men in their particular professions, that it is an honor sought by such men, and that these men usually serve without compensation, except for their daily travelling expenses or per diem charges.

At this point, would Professor Sammi kindly explain the meaning of the word "oligopoli?"

# STATE RIGHTS VERSUS THE FEDERAL GOVERNMENT

By executive order of March 14, 1939 President Roosevelt established the Necedah Migratory Waterfowl Refuge, an area of some 40,500 acres in Wisconsin. Many American foresters, particularly state foresters, have followed with interest the federal government's program for retiring submarginal lands from agriculture. The following opinion of the Attorney General of Wisconsin is published because it has a significant bearing on this refuge. The Wisconsin Conservation Commission is not adverse to the establishment of a federal migratory waterfowl refuge under conditions mutually satisfactory to the federal government and the state, provided the refuge is limited to that portion of the area suitable for migratory waterfowl. The area as proclaimed contains a large acreage primarily valuable for upland game birds. It is the Attorney General's opinion that the State of Wisconsin has not ceded to the federal government jurisdiction over the area known as the Necedah Migratory Waterfowl Refuge.

THE STATE OF WISCONSIN
OFFICE OF THE ATTORNEY GENERAL
MADISON

April 19, 1939.

Conservation Department
State Capitol
Madison, Wisconsin

GENTLEMEN:

You have called to our attention an Executive Order of President Roosevelt, under date of March 14, 1939, whereby a migratory waterfowl refuge, known as "The Necedah Migratory Waterfowl Refuge," is established. These lands, consisting of some 40,500 acres in Jackson, Juneau, Monroe and Wood counties, were acquired by the federal government under authority of Title II of the National Industry Recovery Act, approved June 16, 1933 (48 Stat. 200), and the Emergency Relief Appropriation Act of 1935, approved April 8, 1935 (49 Stat. 115).

These lands have apparently been classified by the Department of Agriculture as submarginal lands, and it was planned to remove such lands from agriculture in this area, which was designated as a sand erosion district.

It was originally contemplated that the state should lease from the counties under fifty-year leases, all of the submarginal lands owned by the counties on tax deeds, and that the submarginal lands in private ownership would be purchased by the federal government and turned over to the state for conservation purposes, although later the federal government commenced the purchase of county-owned lands and the state discontinued its efforts to lease these lands.

The Executive Order, above referred to, among other things, provides:

> It is unlawful for any person to hunt, trap, capture, wilfully disturb, or kill any bird or wild animal of any kind whatsoever within the limits of this refuge, or to enter thereon except under such rules or regulations as may be prescribed by the Secretary of Agriculture.

We are asked whether the State of Wisconsin has lost its sovereignty and jurisdiction over these lands, and whether the Conservation Commission is authorized to enter into long-term leases or treaties with the federal government respecting this area otherwise than as contemplated by sec. 1.056, Wis. Stats. You also inquire if this area may be established as a migratory waterfowl refuge pursuant to sec. 1.036, Stats., irrespective of sec. 1.056.

Sec. 1.056 was created by Ch. 375, Laws 1935, and reads:

> Consent of the State of Wisconsin is hereby given to the United States to acquire by purchase, gift, lease or condemnation, with adequate compensation therefor, areas of land and water within boundaries approved by the governor and the county board of the county in which the land is located, for the establishment of state forests, state parks or other state conservation areas to be administered by the state under long-term leases, treaties or co-operative agreements, which the conservation commission is hereby authorized to enter into on behalf of the state with the federal government.

You state that this enabling act was passed at the request of federal authorities for the express purpose of providing for the administration of the area covered by the Executive Order, and that upon the passage of such section U. S. Comptroller McCarl approved of payment for the lands in question with federal funds.

It is apparently now the position of the federal government, as evidenced by the Executive Order, that it has exclusive criminal jurisdiction over the area purchased by it, regardless of the provisions of sec. 1.056, and irrespective of the fact that the state of Wisconsin has not divested itself of jurisdiction over the lands.

It is true that a state may cede to the federal government the jurisdiction to define and try crimes under certain circumstances. This is exemplified in that portion of sec. 8, Art. I, United States Constitution which grants Congress the power—

To exercise exclusive legislation . . . over all places purchased by the consent of the legislature of the state in which the same shall be, for the erection of forts, magazines, arsenals, dock-yards, and other needful buildings.

Where the United States acquires title to lands which are purchased by the consent of the legislature of the state within which they are situated, for any of the purposes mentioned in sec. 8, Art. I, above quoted, the federal jurisdiction is exclusive of all state authority. *U. S. of America v. Francisco Unzeuta,* (1930) 281 U. S. 138. It would seem, however, that under the decision of *Arlington Hotel Co. v. Fant,* 278 U. S. 439, the scope of the purposes to which such property may be put is as broad as the proper functions of government make desirable. Also, it is to be noted that where a state cedes land to the United States for any of the governmental purposes defined in sec. 8, Art. I of the U. S. Constitution, the jurisdiction of the United States is exclusive; but, if the land is acquired or held in any other way, the United States holds merely as a proprietor, and the jurisdiction of the state is complete, except that it cannot interfere with the use of such land for governmental purposes. *Williams v. Arlington Hotel Co.,* (1927) 22 Fed. (2d) 669. Aside from the question of jurisdiction, the rights of the federal government as a proprietor may exceed in some respects those of a private owner, as is pointed out in 24 California Law Review, 573, 575, but it is unnecessary for us to go into these distinctions here.

In the *Williams case, supra,* it was recognized that where the land is not acquired by the United States under the above mentioned constitutional provision, the state may cede such jurisdiction as it sees fit, and the extent of the jurisdiction of the federal government depends upon the terms of such cession. It is apparent that the lands in question were not acquired by the federal government for any of the purposes mentioned in Art. I, sec. 8 of the U. S. Constitution. This being true, it is clear under the foregoing authorities, and under cases which we will discuss later, that we must find legislative consent on the part of the state of Wisconsin for the exercise of any sovereign jurisdiction over the area by the United States.

Mere ownership of lands and public use by the United States government in the absence of cession of jurisdiction by the state does not confer such sovereignty. *U. S. v. San Francisco Bridge Co.,* (1898) 88 Fed. 891. In this case the court said at pp. 893-4:

. . . It is not alleged in the information, nor does the fact otherwise appear, that the land upon which the new San Francisco post office is being constructed was purchased by the United States with the consent of the state, or that political jurisdiction over the same has been otherwise ceded to the United States by the state. Upon this state of facts, it must be held that the state of California retains complete and exclusive political jurisdiction over such land, and, this being so, there can be no question that persons there committing murder, or any other offense denounced by its laws, would be subject to trial and punishment by the courts of the state. 2 Story, Const. sec. 1227; People v. Godfrey, 17 Johns, 225; Ex parte Sloan, 4 Sawy. 330, Fed. Cas. No. 12,944; U. S. v. Stahl, 1 Woolw. 192, Fed. Cas. No. 16,373; U. S. v. Ward, 1 Woolw. 17, Fed. Cas. No. 16,639; U. S. v. Cornell, 2 Mason, 60, Fed. Cas. No. 14,867. In the case last cited it was said by Mr. Justice Story:

"But although the United States may well purchase and hold lands for public purposes, within the territorial limits of a state, this does not, of itself, oust the jurisdiction of sovereignty of such state over the lands so purchased. It remains until the state has relinquished its authority over the land, either expressly or by necessary implication."

Our own supreme court, in the case of *In re O'Connor,* (1875) 37 Wis. 379, 384, said:

. . . But the United States, as a mere proprietor of land situated within the limits of a state, which was acquired by purchase, without the consent of the legislature, has no paramount authority derived from ownership of the soil. *United States v. Ames,* 1 Wood. & Minot, 76. "The United States, holding lands within the state territory (unless in the cases specified by the constitution), hold them by the same tenure that individuals do." Duncan, J., in *Commonwealth v. Young, supra,* 313. . . . "The rights of sovereignty are never to be taken away by implication." Spencer, C. J., in *The People v. Godfrey.*

The only provision of our legislature other than sec. 1.056, above quoted, which might be deemed a consent of a migratory waterfowl refuge by the federal government in sec. 1.036, Stats., which reads:

Consent of the state of Wisconsin is given to the acquisition by the United States by purchase, gift, devise, or lease of such areas of land or water, or of land and water, in Wisconsin, by and with the consent of the governor of the state, as the United States may deem necessary for the establishment of migratory bird reservations in accordance with the act of congress approved February 18, 1929, entitled "An Act to more effectively meet the obligations of the United States under the migratory bird treaty with Great Britain by lessening the dangers threatening migratory game birds from drainage and other causes by the acquisition of areas of land and of water to furnish in perpetuity reservations for the adequate protection of such birds; and authorizing appropriations for the establishment of such areas, their maintenance and improvement and for other purposes," reserving, however, to the state of Wisconsin full and complete jurisdiction and authority over all such areas not incompatible with the administration, maintenance, protection, and control thereof by the United States under the terms of said act of congress.

It is to be noted, however, that both secs. 1.036 and 1.056 require the consent or approval of the

governor which we understand has not been obtained in the present instance. Furthermore, the Executive Order does not purport to cover areas acquired by the federal government under the Act of Congress referred to in sec. 1.036, and, as previously suggested, the extent of the jurisdiction of the federal government depends upon the terms of the cession by the state. Consequently, the scope of sec. 1.036 is limited to areas purchased by the federal government pursuant to the act of congress approved February 18, 1929.

It might well be that the Conservation Commission acting under sec. 23.09 (7) (d) would have the authority to enter into long-term leases and treaties with the federal government for the taking over and administering of these lands as a conservation project, independently of the authority granted by sec. 1.056. Sec. 23.09 (7) (d) grants the commission broad powers to acquire by purchase, condemnation, lease or agreement, and to receive by gifts or devise, lands or waters suitable for state forests, state parks, public shooting, trapping or fishing grounds or waters, fish hatcheries and game farms, forest nurseries and experimental stations, together with authority to maintain the same. This, however, would in no way increase the sovereignty of the federal government over such areas as respects the regulation of hunting, fishing or trapping. On the contrary, this section clearly contemplates maintenance and control by the conservation commission rather than by some outside agency. Moreover, the very fact that sec. 1.056 was specifically passed for exactly the sort of project here considered, as has previously been brought out, would indicate that the legislature intended this statute should be used in making long-term leases with the federal government rather than sec. 23.09 (7) (d), which does not specifically mention agreements with the federal government.

You are therefore advised that the sovereignty and jurisdiction of the state of Wisconsin include the area described in the Executive Order, and that in so far as the Order attempts to assert federal criminal jurisdiction over the area in connection with hunting and trapping, it is void. Under Sec. 1.01, Stats., it is the duty of the governor and all of the subordinate officers of the state to maintain and defend its sovereignty and jurisdiction. Sec. 29.02 (1), Stats., provides that the legal title to and the custody and protection of, all wild animals within this state is vested in the state for the purposes of regulating the enjoyment, use, disposition, and conservation thereof. The matter of providing for such regulation has been delegated to the conservation commission by sec. 29.174, Stats. Under subsec. (2) thereof, such authority may be exercised either with reference to the state as a whole, or for any specified county or part of a county, or for any lake, or stream, or part thereof, and in view of the conclusion hereinbefore expressed, such jurisdiction of the commission includes the area described in the Executive Order establishing the Necedah Migratory Waterfowl Refuge.

Yours very truly,

JOHN E. MARTIN,
*Attorney General.*

# HOW MUCH FORESTRY IS NEEDED IN THE REDWOODS FOR CONTINUOUS PRODUCTION?[1]

By EMANUEL FRITZ[2]

*Consulting Forester, California Redwood Association*

Prepared in a colloquial style to invite discussion by loggers at the Pacific Logging Congress of the practicability of minimum silvicultural practices recommended for effectuating continuous production in the redwood region this brief paper indicates also that the forester's job is not finished with the preparation of the recommendations; there remains the difficult job of fitting the recommendations to the actual timber and logging conditions, which job falls largely on the logger.

VERY little forestry is required to effectuate continuous production in the redwood region, but that little is important. It requires only a little conscious thought and effort on the part of the logger. This effort should become second nature to him as he gets used to it and it should cost him no money. Actually it should be an economy.

Many loggers, in the redwoods as elsewhere, have gotten an erroneous impression of what forestry really is. There has been so much careless talk and writing about it that the western logger might feel he is not practicing forestry if he does not "sand paper" his cutover land as is done in Europe. Forestry has many degrees of intensity. In some countries forestry can be as intensive as is agriculture. But in our western forests, with old-growth timber still plentiful, forestry must be *extensive* and many of the fine points one reads about in the books must be omitted. No more forestry should be recommended for application on private lands than will pay its way. What little forestry is required at the present time in the redwoods can, I am certain, be proved to pay its way.

Now then, just how much forestry is necessary to put the redwood region on a continuous production basis?

First. Only such trees should be cut as are certain to yield a profit. This is the basis of *economic* selective logging.

Second. As many of the remaining trees should be saved as is practicable.

Third. During logging, the crews should do whatever is possible to prevent damage to the good immature trees.

Fourth. The slash must be burned with a conscious effort to prevent the fire getting out of hand and doing damage to the trees that are to be saved for future growth.

Fifth. The cutover land must be protected along with the operating area and the virgin timber.

Fundamental to these five points is a conscious and definite determination to hold cutover land with a view to returning to it for a second cut and from then to go on a permanent basis. This is a matter for the *owner* to decide. The others are problems for the *logger* to solve.

Let's go over the five points again in some detail. As to cutting only profitable trees and leaving immature trees, that has always been the practice. But, in the past, the unprofitable trees were left flat on the ground where they are only in the way and where they can do no one any good. They are a total loss. They should be left standing for a second cut later on. But how can they be left standing when wire-rope systems of logging are used? It has been the practice in the redwoods to "tight-line" the yarding lines across the land when a change of line must be made to a new tail tree. Is it feasible to pull the lines back toward the spar tree and run them out again on a new road? It is being done in other regions. What change is needed and what would it cost to do the same in the redwood country? That's a question for the logger to investigate and answer. He has had far more difficult problems to solve and has always solved them. Does this one have him "stopped?" I don't think so, but let's give it some thought and figure out what can be done with our present steam equipment.

Where tractors are used the problem is simpler. The tractor can dodge the trees that should be saved. Nevertheless, the drivers must be ordered to avoid banging into the trees and knocking off their bark, and the hooktenders must be instructed to so lay out the roads that the logs being yarded, and their lines, will not tangle with the standing trees.

Perhaps it would be a good idea to put some kind of a mark on those of the immature and other trees that are most worth saving and then

[1]Presented at the Pacific Logging Congress, Tacoma, Wash., October 19-21, 1938. Keynote of the Congress program was "Logging for Continuous Production."

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see to it that the choppers, tractor drivers, and others do not damage them. Of course, we cannot save all the immature trees, but a strong effort should be made to save as many of the best of them as is possible. In other words, damage should be held down to what is unavoidable. If eight or ten such trees per acre can be saved there is a certainty that the operator can come back for a second cut after he has finished cutting over the entire area, because by that time, 20 or 30 years hence, these trees will have grown much larger and more valuable. They speed up their growth immensely when released from crowding.

Now, here is something that the logging boss should be especially interested in. His efficiency is judged, as a rule, by his logging costs. Suppose the owner decides to go "all the way" toward continuous production. Then the logging boss can change his entire attitude toward the logged over land. In the past he has figured that the owner will never go back to the cutover acres, and therefore, he, the logger, feels he must take off everything of any present value or otherwise lose it. But when the operation is to be on a continuous production basis, he can say, "Well, as long as I can come back over this cutover land, I won't cut everything, but take only those trees which will be cheapest to log and which will pay their way. I can make a better cost showing in spite of the greater trackage I will have to build and the more landings I will have to have, and furthermore, I will be leaving a sweet lot of stuff that will be worth logging when I get ready to come back." If the logger looks at it that way, forestry will take care of itself automatically.

It has been proved by many studies in other regions that by cutting only certain trees and leaving the others, greater margins for stumpage and profit are possible. Such studies are needed in the redwoods and they should be undertaken by the logging departments themselves. Only in this way will the logger find out what and how much he should cut or leave to get the lowest logging cost and the most profitable logs for the mill. It's a nice job to undertake, and I think every logger should give it a lot of thought and get studies under way soon. They need not be elaborate. The simpler they are, the better.

Now a few words more about fire. Most loggers think foresters are "cracked" on fire protection. Actually, foresters look upon fire as a nuisance that interferes with their real work and which hurts also your own business. It is not enough to leave trees. They must be left in good condition and they must be protected, otherwise the savings already noted will be lost to the owner. If the trees are barked or burned at the base, they do not have the capacity to grow as fast as they would if unharmed; furthermore, decay will get into the injured portions. Slash, of course, must be burned. But it is important to burn it carefully enough that no serious damage is done to the trees. If the slash is burned broadcast the great heat rising to the crowns will kill the foliage. Fortunately, this does not kill redwood, but it does set the trees back many years in growth, and worse yet, such fire damage stimulates sprouting all along the trunks. These sprouts will grow into limbs and make all future growth of a common grade, whereas it should be, and can be, of an upper grade. The question then is: How can we get away from the old broadcast burning method and do less damage to our residual trees? Is it feasible to burn in spots or in strips? It has been done in several cases and it has given good results. Is it necessary to call in the entire crew at slash burning time and have all hands look after burning, or can the burning be handled more cheaply if assigned to one man who will burn in small spots over a longer period of time and whenever the weather makes it safe? Slash burning is a special job and, it seems to me, should be assigned to a fire boss working under the logging superintendent. He would look after general protection during the summer and after slash disposal when the rains have set in. It would be his job also to keep fire out of cutover land after the loggers have moved away. There is no gain in leaving trees if they are not protected.

To sum up, here is what I think faces the logger:

He can't get full advantage from economic selective logging if he doesn't find out which trees are running up his costs. Once he knows which ones are profitable, he must find out how to leave the others intact and how to burn the slash without damaging them. And, of course, he must have a good fire department to protect all his land.

This is all the forestry we need at this time in the redwoods. As a starter, I would suggest you do not look upon selective logging as forestry, but rather as good logging business. And I feel certain it will pay well. The job now is, "How can it be effectuated in the woods?"

# TRENDS IN LUMBER PRODUCTION IN OREGON AND WASHINGTON

By HERMAN M. JOHNSON

*Pacific Northwest Forest and Range Experiment Station*

The lumber industry of Oregon and Washington is of outstanding value not only to these two states but to the entire nation. In these states is produced a considerable part of the entire lumber requirement of the nation. The trend of lumber production in them, therefore, is of outstanding interest to foresters and others throughout the entire country.

OREGON and Washington contain the last great coniferous stands in the United States. Approximately two-fifths of the nation's remaining timber supply is within their boundaries. These states are divided by the Cascade Mountains into two distinct timber-growing regions. East of the mountains the country is a high, semiarid plateau where ponderosa pine predominates. West of the mountains, a region of greater rainfall, Douglas fir is the major species. Although lumbering in these states has been carried on for over a century, and on a large scale for the past thirty years, there is still a vast supply in virgin and second-growth forests. Federal Forest Survey compilations show the total stand of merchantable-sized timber in the Douglas fir region to be 546 billion feet, log scale, and in the ponderosa pine region to be 132 billion feet. The figures for both regions include a negligible quantity of hardwood species.

The forests have been the backbone of industrial development of Oregon and Washington from the earliest period and are still the mainstay of industry and trade. It is estimated that at the present time the forest industries in these states furnish support, directly and indirectly, to roughly 40 percent of the population and account for about 60 percent of the industrial payroll, excluding agriculture.

In 1827 Dr. John McLaughlin, chief factor of the Hudson's Bay Company, set up the first sawmill of record on the Pacific Coast, and also the first west of the Mississippi River. Further operations were soon added in the Willamette Valley, Columbia River, and Puget Sound regions. The first impetus was given the industry by the California gold rush of 1849. The next expansion began with the furnishing of material for the Union Pacific Railroad in California and was further increased by the building of the Northern Pacific to Puget Sound. Coincident with the development of railroad transportation and reduction of freight rates, the rapid settlement of the territory west of the Missouri River, and the decreasing lumber cut of the Lake States, the lumbering industry of the Douglas fir region in particular expanded rapidly.

The early sawmills were simple, water-driven plants producing rough green lumber. With the expansion of markets came a gradual change in the type of mill, until now the typical mill is a large, complex plant composed of many units and equipped to turn out lumber in a great variety of forms and grades. At least 90 percent of the lumber now cut is manufactured in plants ranging in daily capacity from 100,000 to 500,000 feet. There is, however, a large number of small mills cutting boards, plank, ties, and dimension stock.

In 1905 Washington became the leading lumber producing state in the nation, which place it has since held, except in 1914, when it was exceeded by Louisiana. The cut in Oregon has never reached the proportions attained in Washington. Excepting in 1921 and 1922, Oregon has ranked second in lumber cut since 1920. Peak production in Washington occurred in 1926 with 7,546 million feet, board measure; and in Oregon in 1929 with 4,784 million feet. Previous to 1930, Washington greatly exceeded Oregon in lumber output. During the past eight years there has been a marked decrease in this differential until in 1937 it was only about 350 million feet in favor of Washington. It is probable that within the next decade the Oregon cut may equal or exceed that of Washington.

In the past a large footage of Washington logs was sawed in mills on the Oregon side of the Columbia River. This situation is being reversed gradually as each year greater quantities of Oregon logs are shipped to Grays Harbor and Puget Sound mills.

The trend of lumber production, by species, for Oregon and Washington from 1904 to 1937, inclusive, is shown in Figures 1, 2, and 3. Figure 1 is of special interest in that it reflects the influ-

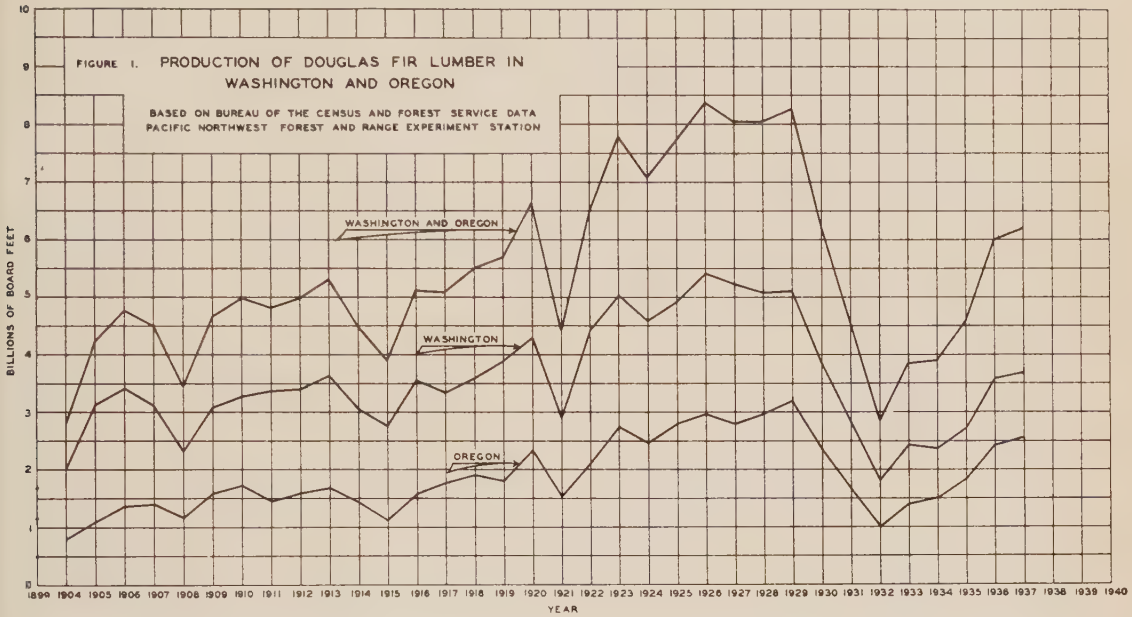


FIGURE 1. PRODUCTION OF DOUGLAS FIR LUMBER IN WASHINGTON AND OREGON
BASED ON BUREAU OF THE CENSUS AND FOREST SERVICE DATA
PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
WASHINGTON AND OREGON
WASHINGTON
OREGON
BILLIONS OF BOARD FEET
YEAR

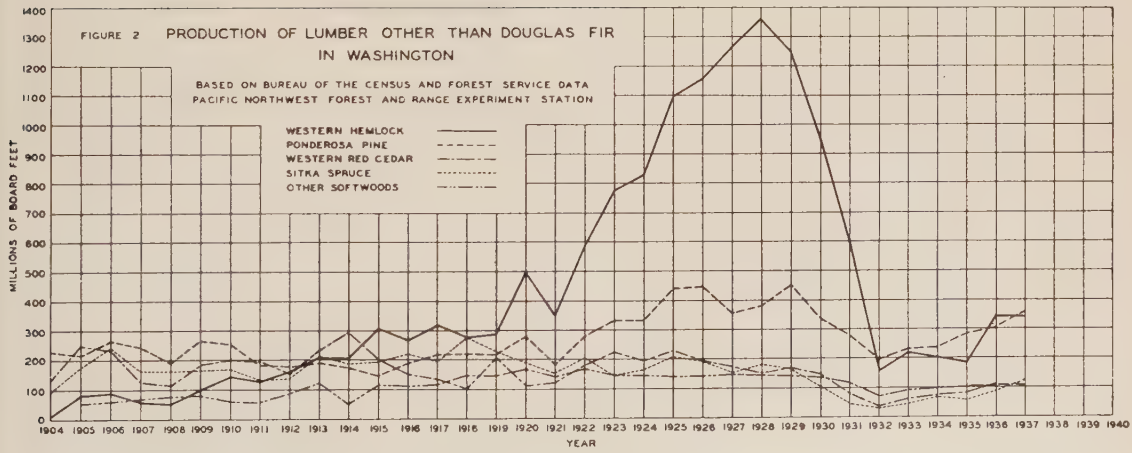


FIGURE 2 PRODUCTION OF LUMBER OTHER THAN DOUGLAS FIR IN WASHINGTON
BASED ON BUREAU OF THE CENSUS AND FOREST SERVICE DATA
PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
WESTERN HEMLOCK
PONDEROSA PINE
WESTERN RED CEDAR
SITKA SPRUCE
OTHER SOFTWOODS
MILLIONS OF BOARD FEET
YEAR

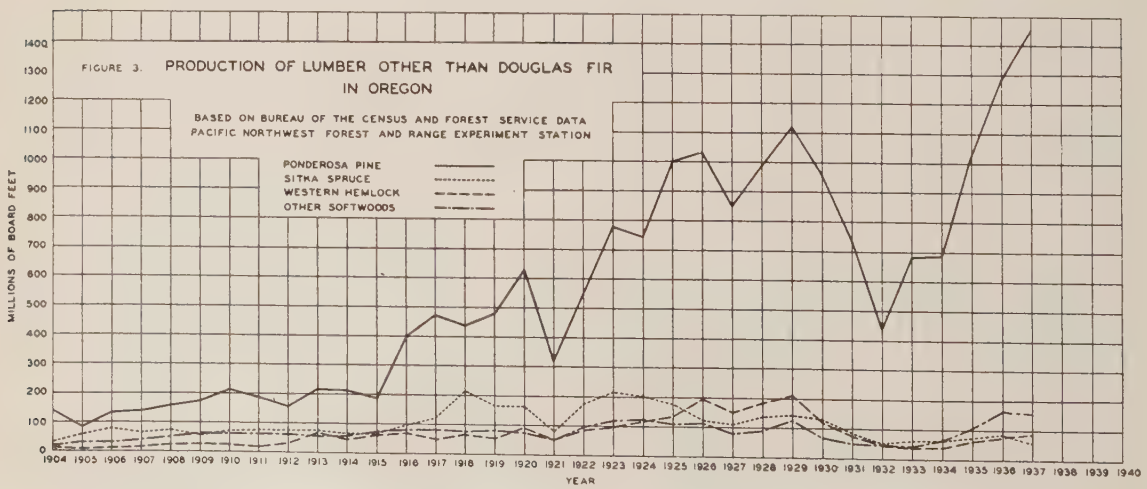
ence of changing economic conditions and great calamities on Douglas fir production. These are more marked in this species than in others because of the greater use of Douglas fir in construction. Conspicuous changes in production were notable at the time of the San Francisco and Valparaiso, Chile earthquakes and fires of 1906, the 1907 panic, the beginning of the World War (1914), entrance of the United States into the war (1917), post war inflation (1918-1920), the 1921 panic, the Japanese earthquake (1923), and the world-wide depression. Douglas fir production in 1932 exceeded that of 1904 by only about 2¼ million feet. Renewed stimulus was given the industry by the National Recovery Act in 1933. It is doubtful, however, if production again reaches the 1926-1929 peak.

The rapidly increasing production of western hemlock mostly in Washington between 1922 and 1928 and the rapid decrease following 1929 are notable (Fig. 2). Markets for this species prior to 1922 were very restricted, but about this time individual operators and the West Coast Lumbermen's Association, recognizing the good qualities of this wood, started a vigorous market extension campaign accompanied by greater care in manufacturing and seasoning. Enlarged markets, both foreign and domestic, led to the establishment of several mills for the exclusive production of hemlock, and an increased hemlock cut by mills normally producing only Douglas fir.

Western hemlock production reacted more quickly and more drastically than did Douglas fir to the collapse following 1929. This may have been caused by the consumer's preference for Douglas fir. Also it was about this time that Japan, which had been a big market for hemlock lumber, established small mills and imported increasing quantities of hemlock logs instead of lumber and squares. As a result of these two factors, production dropped in 1932 to the 1910 level. It is not anticipated that hemlock production will ever again reach the 1928 level owing to marketing difficulties and to the fact that pulp mills are absorbing increasingly large quantities of hemlock logs at a price equal to and in some cases exceeding what the lumber industry can now afford to pay.

The rapid increase in ponderosa pine production in Oregon following the 1932 low is the outstanding feature presented in Figure 3. With minor exceptions the general trend in pine production in this state has been upward. This gradual increase in production was given a decided impetus during the World War. Along with other species, there was a marked decrease during the 1921 panic. Following this came a rapid acceleration due to an extension of markets which led to the establishment of additional production units, particularly in the Klamath Falls-Lakeview district. Following 1932 the rate of increase in production exceeded that of Douglas fir, and in 1936 and 1937 the output exceeded that of any previous year.

Cedar, spruce, and other softwoods species are of minor consideration from a production standpoint although important in their respective fields of utilization.



# A WORK UNIT EROSION CONTROL SURVEY

By KENNETH J. SEIGWORTH
*Tennessee Valley Authority*

THE time and cost required to control erosion in specific geographic areas are of fundamental importance in the planning and execution of watershed protection and flood control programs.

Public and professional opinions agree as to the severity and extent of soil erosion in many major watersheds and as to the desirability of control. Numerous surveys have been made which rather accurately reflect the extent and character of erosion. Other surveys have shown the rapidity with which sediment is being deposited in harbors, in the major river bottoms, and behind water storage structures. However, review of the literature and discussion with persons engaged in erosion control activities have resulted in scant information as to time, labor, and cost of erosion control in any specific area or as to how to obtain such information.

In many sections of the country there are two major types of erosion situations. First, there is the situation on tillage and pasture lands which can be readily corrected by changes in agricultural practice. Here, the control job is mostly education of the land operator and adoption by him of certain prevention practices such as crop rotations, strip cropping, contour furrows, terracing, pasture improvement, and other desirable agricultural methods. Erosion on these areas is largely confined to sheet washing and incipient gullying, which does not, at present, preclude agricultural use.

The second situation is that of excessive sheet erosion and gullying which has advanced to the point where engineering and forestry measures involving labor, materials, and technical skill not possessed by the farmer are required. Such erosion situations are usually beyond the physical and financial ability of the owner to control without considerable public assistance in the form of labor and technical guidance. It is this type of erosion with which the Department of Forestry Relations of the Tennessee Valley Authority is normally concerned.

Some of the reasons for evaluating erosion conditions on a quantitative basis in terms of control requirements which can be related to time and cost are:

1. To permit comparison of various areas to determine the more critical ones.

2. To enable decision as to desirable methods of correction (e.g., advice, demonstration, or contributed labor and materials—singly or in combination).

3. To determine the amount of labor and technical assistance required and the methods by which, and locations in which, such labor and assistance can be used most effectively.

4. To enable discretion as to allocation of funds to this particular phase of watershed protection.

The Department of Forestry Relations, in an effort to find an economical method for gathering erosion control work-unit data for the excessive sheet and gully type of erosion, has developed a basis for work-unit estimate, field procedure, and record which may be of interest to others engaged in erosion control and watershed protection. The technique described may be employed for areas of any size where maps showing forest cover in reasonable detail are available (aerial mosaics, planimetric or topographic) and where open areas are reasonably accessible to, but not necessarily visible from, an automobile.[1] To date, six areas averaging 52,500 acres and totaling 315,000 acres, have been surveyed. These are scattered from near Georgia to the Virginia border in eastern Tennessee. They represent a variety of topographic, agricultural, economic, and travel conditions.

[1]This technique was developed through an effort to test a sampling method which could be applied over the entire Tennessee drainage—an area of 26,000,000 acres. The method being tested involves possible correlations between erosion control work loads as recognized by the Department of Forestry Relations and a classification of erosion conditions determined as part of a classification survey conducted by the Department of Regional Planning Studies. (Hudson, G. D. The unit area method of land classification, Ann. Assoc. Amer. Geographers. Vol. 26, 1936.) Results of this test are now being analyzed and will be recorded in a future manuscript.

### Erosion Recognized

This survey recognized all erosion occurrences on non-crop lands (idle areas and unimproved pastures) and all gully erosion where control involved measures other than changes in agricultural practices (the type of erosion where public assistance in the form of labor, of technical advice, or of forest planting stock is required for satisfactory control). It studiously avoided consideration of pasture and crop land erosion where forestry methods of control are not applicable.

### Field Procedure

An erosion control engineer and a forester, each with more than three years of local experience, comprised the field survey party. They were equipped with photostatic reductions (1 inch = 2,000 feet) of planimetric maps which showed all topography except elevations. They traveled by automobile, supplemented by walking to insure complete, close-up visibility of all open areas. Forested lands were not visited because of the relative non-existence of gully erosion on such areas. The party carefully inspected every erosion situation. It was assumed in each case that the landowner would need assistance in control of the erosion. The probable control measures on each situation were decided upon and estimates made as to team-day, man-day, and forest planting stock requirements. Acreages were estimated by eye. Type of control measures, man-days required for preparatory and protection jobs, man-days required for reforestation, and number and species of trees required were estimated and recorded on tally sheets for each erosion occurrence and were summarized for each unit area.

In each instance, control measures were considered in the light of local availability of necessary materials such as logs or rock, and brush or straw.

Two standards of control were considered and appropriate estimates made for each: one, the method, or combination of methods, which would be employed to reduce erosion to a minimum in a short time with a plentiful labor supply (such as C.C.C. or W.P.A.) and with competent technical supervision on the job at all times (called "Public Labor Control" in the Watershed Protection Division of the Tennessee Valley Authority); the other, the method which the average intelligent landowner might reasonably be expected to carry out (considering available time and physical and financial ability) when intermittent technical supervision and forest planting stock are available (called "Landowner Control" in the Watershed Protection Division of the Tennessee Valley Authority). In the second case, it was recognized that labor would be limited, that control measures would be spread out over a longer period, and that only the most simple engineering devices could be attempted.

It may be noted that both these approaches are being used by the Department of Forestry Relations in the Tennessee Valley, and that all estimates are based on such experience. It may be noted further that the general tendency in the department's erosion control work has been to reduce engineering work to the minimum; but adequate site preparation is necessary for successful revegetation. Another trend is in the direction of landowner control; however, the department has made use of available public labor in expediting the control program during the depression period.

Man-day was defined as that amount of work which can be accomplished by an average farmer or farm laborer working eight hours.

In estimating team days (horses or mules, eight hours) the basis of estimate was such jobs as bank sloping, contour furrowing, and material hauling, which can be done more efficiently by team than by hand.

Emphasis was placed on vegetative control. In practically all cases, forest cover was indicated as the ultimate control, although the amount of engineering work preparatory to establishment of the plantations varied widely.

### Results and Costs

Table 1 shows size and location of the surveyed areas and briefly summarizes the results in control work-units; it also shows the number of man-days actually spent by the field party in surveying each area and the amount of travel incurred.

Examination of the field tally sheets shows that 79 percent of the estimated man-days required for the erosion control job on the "Public Labor Control" approach is in preparatory (engineering) and protection (fencing) work, and 21 percent is in reforestation or tree planting. On the "Landowner Control" approach, 53 percent of the job is in the preparatory and

protection work, while 47 percent is in reforestation. All the estimated team days are in the preparatory and protection phases.

Cost of making the survey was .463 man-days and $1.52 automobile travel per 1,000 acres. Cost increased with increase in frequency and severity of erosion occurrences. An equally significant cost factor is amount of walking required to see the erosion occurrences. The Knox County area was the first one surveyed and some of this expense is chargeable to experience. In the Jefferson County area, inclement weather and certain administrative difficulties influenced the survey cost.

In such a survey, the results are only as reliable as the ability of the men who make the estimates. On this particular job, one of the most competent erosion control engineers (junior grade) in the Watershed Protection Division has been completely responsible for the preparatory and protection estimates. Several individual foresters (junior, assistant, and associate grades) participated in the reforestation estimates. It is believed that better results are obtained when both forestry and engineering viewpoints are available on such a survey.

The field work of the party was checked frequently on the initial area. It developed that about one day in five on the part of a supervisor thereafter would assure uniformity of approach and reliability of estimate. It may be axiomatic that the more experienced and better qualified the field estimators, the less supervision required.

It should not be concluded that the areas covered in this survey are typical of the entire Tennessee Valley. They represent fair samples of the eastern Tennessee and possibly southwestern Virginia portions only. Neither should it be concluded that a 100 percent survey of a major watershed is necessary to approximate the erosion situation.

This paper suggests one method of making an erosion control survey in terms of fairly tangible work units on large areas where reasonably accurate information is desirable and where maps which show roads and forest cover or open lands are available. It describes and summarizes an inventory of the erosion control job with which the Department of Forestry Relations of the Tennessee Valley Authority is normally concerned in the light of currently accepted standards of desirable land use and in the light of current erosion control practices, on six areas totaling 315,200 acres in eastern Tennessee. It also includes personnel and travel expenditures in terms which may be translated into dollars and cents costs.

Table 1.—Results and Cost Summary of Work Unit Erosion Control Survey on Six Areas in Eastern Tennessee; 1937-1938

| Location of area | Size of area | Control requirements | | | | Survey cost | |
|---|---|---|---|---|---|---|---|
| | | Team days | Trees | Man days—Public labor control | Man days—Landowner control | Man days | Travel[1] |
| | *acres* | | | | | | |
| Knox County | 55,600 | 458 | 1,298,300 | 11,641 | 7,379 | 30 | $ 63.65 |
| Hamilton, Meigs, and Bradley Counties | 52,900 | 407 | 1,252,800 | 6,951 | 4,362 | 18 | 73.90 |
| Blount County | 48,500 | 187 | 1,241,500 | 4,714 | 2,523 | 18 | 99.15 |
| Jefferson County | 46,500 | 1,663 | 2,377,400 | 26,620 | 5,953 | 44 | 128.07 |
| Monroe County | 51,200 | 618 | 1,265,600 | 7,243 | 3,412 | 16 | 51.63 |
| Hancock-Hawkins Counties | 60,500 | 585 | 938,150 | 6,417 | 3,312 | 20 | 62.18 |

[1]Automobile travel at 4.5 cents per mile.

# SOIL FREEZING AS AFFECTED BY VEGETATION AND SLOPE ASPECT

By B. C. GOODELL

*Central States Forest Experiment Station*

Freezing of soil practically, if not completely, closes it to the infiltration of water and thus results in increased surface run-off. Any agency which tends to prevent soil freezing tends to keep the soil permeable during all or a greater portion of the year and thus decreases the frequency of high rates of surface run-off and consequent floods. The following article describes a study of soil freezing in which were compared the depths of freeze under different types of vegetation and also with different conditions of slope aspect.

IT is generally accepted that any form of vegetational cover over the soil reduces soil freezing both in depth and in time-length of existence. It is also known that between vegetational types there are various degrees of effectiveness in this respect. Very few studies have been made, however, to determine the actual extent by which a vegetational cover reduces freezing, how it varies between forest and herbaceous cover, and the part played by factors of ground topography.

A knowledge of these and other conditions which bear on soil freezing is perhaps particularly important in the Central States because of the heavy winter rains to which this region is subject and the accompanying high hazard of winter floods—a hazard which is increased by frozen soils.

In the fall of 1937, a study of soil freezing was initiated by the writer at the Central States Forest Experiment Station to determine the effect of two factors on the depth to which freezing penetrates: the effect of vegetational cover, and the effect of slope aspect.

## Description of Experimental Areas

Sites were chosen for the study in the locality of the Southern Illinois Branch Station, Hardin County, Ill., on areas having a vegetational cover typical of the locality both in kind and in degree of cover intensity.

To evaluate the first factor, three pairs of sites were chosen presenting two contrasts in vegetational cover; one between forest cover and pasture, the other between forest and clean cultivated cropland. For the second factor, slope aspect, one pair of sites was selected consisting of areas on opposite facing slopes having similar vegetational cover.

The essential characteristics of all sites are summarized in Table 1, in which sites *A*, *B*, and *C* designate those used for vegetational cover comparison, and sites *X*, those for the study of slope aspect effect.

Between the individual sites of the *A*, *B*, and *C* pairs, the factors of slope, aspect, and elevation were closely similar, as Table 1 indicates. Between the individual *X* sites, which lay on opposite sides of an east-west ravine, all conditions were similar except the one of aspect.

The pasture sites of all areas were characterized by a rather poor, light sod cover, typical of the closely cropped pastures in the locality. The wooded sites were also typical of the locality, but differed in one important respect from the majority of woodlots of the Central States in that they had not been grazed or burned over for several years. They thus contained a good depth of ground litter. On the cornfield of *C* site there still remained a sparse scattering of standing stalks but the soil itself was bare.

The soil of the whole locality of the study was originally of one type and consisted of a mantle of yellow silt loam, overlying clay. In the wooded areas this same soil still existed but on the pastured and cultivated sites erosion had removed the silt topsoil exposing a clay or clay loam surface. This difference between the soil of forested and non-forested sites was unfortunate, but that it had any appreciable bearing on the results obtained is very doubtful.

## Experimental Methods[1]

The method of the study was to compare the depth of freezing on each site of a pair by measurements taken on both sites during the same day.

To insure sampling of sufficient degree to give a good average of the frozen depths, thirty plots

[1]All field work involved in the study was in charge of C. E. Sutton, superintendent of the Southern Illinois Branch Station. The writer is also indebted to him for many suggestions relating to experimental set-up and procedure.

Table 1.—Site Characteristics

| Sites | Vegetational cover | Average slope (approx.) | Aspect | Litter depth (Inches) |
|---|---|---|---|---|
| | | *Percent* | | *Mean St. error* |
| A | Pasture—Andropogon, Lespedeza sp. | 10.1 | N 20° E | |
| | Woods—White, red, black oaks (60 years) | 11.7 | N 17° E | 2.31 ± 0.082 |
| B | Pasture—Andropogon, Lespedeza sp. | 18.9 | N 67° W | |
| | Woods—White oak (60 years) | 24.2 | N 67° W | 2.06 ± 0.117 |
| C | Cropland—Corn | 7.6 | N 10° W | |
| | Woods—Oak-hickory (60 years) | 11.0 | N 5° W | 2.12 ± 0.142 |
| X | Pasture—Andropogon sp. | 17.4 | S | |
| | Pasture—Andropogon sp. | 17.4 | N 10° W | |

ten feet square were mechanically laid out on each site. Each plot was marked by a center stake and the measurements made at points chosen mechanically around this stake. One measurement was made on each plot at each day of sampling, each measurement being made at a distance of one foot from the point of previous measurement, following the pattern of concentric, clockwise circles around the center stake.

Actual measurements were taken by means of a frozen soil borer or auger developed especially for the purpose,[2] and depths were recorded to the nearest one-tenth-inch. While working on the plots the men were careful not to disturb the natural conditions by unnecessary trampling or movement of litter.

It was planned that measurements would be made at regular intervals of one week. However, the winter proved to be so mild that freezing was only periodic and measurements were taken only when periods of freezing occurred.

After all freezing was over for the winter, careful measurements to the nearest one-tenth-inch were made of the litter depth on each plot of the wooded sites, and averages were computed for each site (Table 1). The instrument used for this work was a copy of the one developed by Dr. John T. Auten for this specific purpose.[3]

In conjunction with the soil freezing measurements, a record of air temperatures was maintained by means of a thermograph located in a standard instrument shelter at the branch station headquarters. This location was central with respect to the sites of freezing measurements but at some distance from each. Furthermore, the instrument shelter was located within an extensive wooded area which probably influenced the recorded temperatures to some degree, causing higher minimum and lower maximum values than would have been recorded in the open pastures or cornfield. Nevertheless, for purposes of evaluating general winter conditions and for possible comparison with the results of future similar studies, the records are believed to be satisfactory.

The intention was that measurements of snow depth would also be made on each experimental plot at each time of soil sampling. There was only one snowfall of appreciable depth during the entire winter, however, and no soil freezing occurred during the period of its existence.

## Results

*Effect of vegetation.*—The results of the study to determine the effect of vegetation on soil freezing are given in Table 2. Comparisons should be made only between the sites of any one pair since factors of slope, aspect, and elevation vary between pairs of sites. As shown, there was no freezing in the soils of any of the wooded sites. Freezing in the pasture soils occurred to a maximum measured depth of about 1.5 inches and freezing in the cornfield reached a maximum measured depth of about 5.5 inches.

On one occasion, January 30, a hard rain was followed immediately by a sudden and severe drop in temperature. This combination resulted in ice formation within the litter of the wooded sites, freezing the litter together in icy plates. The soil beneath, however, did not freeze. A coating of ice was also formed over the soils of the open sites by these same weather conditions.

The depth of freezing in the cornfield soils were somewhat effected by the plow furrows. This had been expected and allowance was made by scattering the measurements with respect to the furrow topography and averaging all values.

[2]Goodell, B. C. A soil boring tool for frost depth determination. Jour. Forestry 37: 457-459. 1939.

[3]Auten, J. T. A soil study of the Mont Alto state forest. Penna. Dept. Forests and Waters. Research Bull. 4. 1930.

It was found that with a light freeze, deepest frost penetration occurred at the ridge crest and least in the trough bottom. With a heavier freeze this differentiation became less.

All freezes during the winter were of brief duration, most of them so brief that complete thawing had occurred before all sites could be visited for sampling. Also, it is unlikely that the measured depths of freeze represent the maximum depths actually attained. There were other freezes so light and transient that no measurements at all could be made of them, such as freezes of less than one day in duration.

*Effect of slope aspect.*—The data showing the effect of aspect on soil freezing are presented with statistical interpretations in Table 3. Since freezing occurred on each of the pair of sites chosen to study this factor, the *t* test of significance was applied to the difference in mean frozen depth occurring on each date of measurement. The results show a very high significance that the difference in freezing depth between north and south slopes was due to the factor of aspect alone. As presented, the freezing on the north slope was consistently much deeper than on the south slope.

The summary of the winter temperatures as obtained from the thermograph charts is presented by Figure 1. This graph was made by taking from the charts the hourly temperatures during each day of the period of operation or from November 24, 1937, to March 31, 1938 and totalling these values for each day. The totals were then plotted against dates of occurrence with the zero line taken at the abscissa corresponding to 32° F. maintained for 24 hours. On the resulting graph, Figure 1, the area above the zero line represents the hour-degrees of thaw for any period chosen; the area below the zero line, the hour-degrees of freezing.

As shown by this figure the winter was abnormally mild. There were only five periods during which the temperature curve fell appreciably below the freezing level for more than one day. (One of these five periods was just closing when the thermograph was put into operation, and so only shows up on the first ordinate of the graph). The least intense of these five cold spells, the one of January 7-8, was accompanied by about 550 hour-degrees of freezing temperatures and resulted in freezing in all of the pasture sites and the cornfield site. The

Table 2.—Summary of Mean Frost Depths for Sites A, B, and C

| Date | Depth of freezing, mean of 30 measurements (inches and hundredths) | | | | | |
|---|---|---|---|---|---|---|
| | A sites | | B sites | | C sites | |
| | Pasture | Woods | Pasture | Woods | Cornfield | Woods |
| | Mean St. error | Mean | Mean St. error | Mean | Mean St. error | Mean |
| Nov. 22, 1937 | 1.31 ± 0.08 | 0.00 | | | | |
| Nov. 24, 1937 | | | | | 3.05 ± 0.18 | 0.00 |
| Dec. 6, 1937 | 1.23 ± 0.07 | 0.00 | 1.33 ± 0.06 | 0.00 | | |
| Dec. 9, 1937 | | | | | 5.54 ± 0.09 | 0.00 |
| Jan. 8, 1938 | 1.49 ± 0.06 | 0.00 | 1.46 ± 0.08 | 0.00 | | |
| Jan. 10, 1938 | | | | | 2.58 ± 0.14 | 0.00 |
| Jan. 31, 1938 | | | 1.17 ± 0.09 | 0.00 | | |
| Feb. 2, 1938 | | | | | 1.96 ± 0.14 | 0.00 |
| Feb. 28, 1938 | | | | | 1.34 ± 0.06 | 0.00 |

Table 3.—Freezing Depths on North and South Slopes

| Date | Depth of freezing[1] | | Difference (inches) | "t" value of difference[2] | Value of "t" for 1 percent level significance[3] |
|---|---|---|---|---|---|
| | South aspect | North aspect | | | |
| | *Inches* | *Inches* | *Mean St. error* | | |
| Dec. 3, 1937 | 0.00 | 0.62 | 0.62 ± 0.04 | 15.50 | 2.66 |
| Dec. 7, 1937 | 1.64 | 2.37 | 0.73 ± 0.13 | 5.62 | 2.66 |
| Jan. 8, 1938 | 0.88 | 1.71 | 0.83 ± 0.10 | 8.30 | 2.66 |
| Feb. 1, 1938 | 0.84 | 1.98 | 1.14 ± 0.15 | 7.60 | 2.66 |

[1]Basis: 30 determinations on each slope on each date.
[2]Method from *Statistical Methods* by George W. Snedecor. 341 pp. 1937.
[3]Idem. Table 3.8, page 55.

period of most severe cold (in point of total hour-degrees below freezing), the one of December 5-12, produced no freezing in the forested soils even though accompanied by over 1800 hour-degrees of freezing temperatures.

## Summary of Results

1. Freezing occurred frequently and to an appreciable depth in pasture and cornfield soils during weather which produced no freezing in comparable forest covered soils.

2. Freezing was considerably deeper on a north facing slope than on a comparable south slope; the difference was caused in all probability by the factor of aspect alone.

The results obtained from this study are in line with common judgment and casual observations. However, factual bases for such conclusions are very meagre, particularly in the Central States region.

The data here presented give an additional factual foundation for the conclusion that freezing is of less depth in forested soils than in pasture or in clean cultivated soils, and also support the corollary that freezing of forest covered soils is less frequent. It is furthermore very definitely shown that the factor of aspect should be considered in any study of soil freezing under natural conditions.

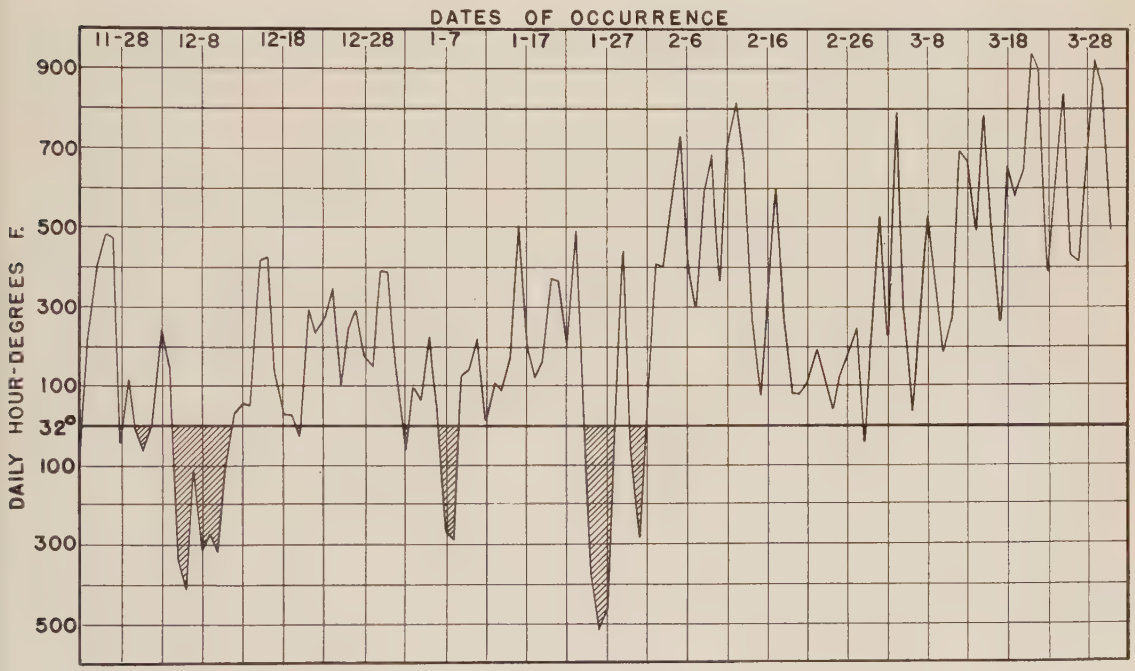



Fig. 1.—Daily hour-degrees plotted against dates of occurrence with 32° F. as zero line. Nov. 24, 1937 to March 31, 1938.

# MULTIPLE USE SPRAYER FOR THE APPLICATION OF LIQUID FERTILIZERS, INSECTICIDES, AND SOIL DISINFECTANTS IN FOREST NURSERIES

By W. H. BRENER[1]

*Wisconsin Conservation Department*

The production of nursery stock involves a large amount of labor. A material reduction in the amount of labor required would of course decrease production costs. In the following article a mechanical sprayer is described which makes possible the application of liquid fertilizers, insecticides, and soil disinfectants at low cost.

A PERIODIC application of various chemical solutions, used for the control of parasitic organisms and for the maintenance of soil fertility, is a regular practice in the management of forest nurseries. The application of sulfuric acid, formaldehyde, and other fungicides at the time of seeding is necessary in all nurseries subject to damping-off disease. The treatment of nursery beds with insecticides, such as Bordeaux mixture or tobacco extract, is required whenever the appearance of parasitic insects is detected. The application of nutrient salts in solution often becomes urgent due to a suddenly developed soil deficiency. An excessive rainfall promoting the leaching and consumption of nutrients, or unexpectedly high germination of seeds and overcrowded beds, may call for a treatment of stock with a complete fertilizer. A high carbon-nitrogen ratio caused by application of raw organic remains, formation in soil of insoluble iron and aluminum phosphate compounds, the loss of replaceable potassium due to a deficiency of base exchange material, and a number of other conditions may develop a need for an immediate re-establishment of a proper balance of nutrients. This is accomplished by the application of ammonium sulfate, ammonium phosphate, potassium sulfate, potassium nitrate, or other readily soluble synthetic fertilizers. Certain minor elements, as well as indol-acetic acid in combination with vitamin B, may also be applied in liquid form either for the improvement of soil fertility, the promotion of stunted root growth, or regeneration of the roots injured by white grubs or toxic agents.

Up to the present time, the application of chemicals in solution has been largely accomplished by watering cans, a slow and costly practice. In some instances, the solutions were forced through the Skinner overhead system at a risk of plugging and corroding the pipes. Some improvement in application of liquids was made by the use of small tanks or barrels, mounted on wheels and pushed along the seed beds. None of these methods, however, maintain a constant concentration of applied solution, or distribute the liquid uniformly over the treated area. To remedy these defects, a suitable sprayer has been assembled by the writer.

A second-hand, one-and-half ton truck was stripped of the rack, fenders, and cab. The wheels were turned about to increase the gauge and thus permit the operation of the truck over a standard four-foot seedbed. A 200-gallon Meyers' barrel-like wooden tank was mounted on the truck and equipped with a pressure pump to maintain a uniform discharge of the liquid. Within the tank a powerful agitator of the propeller type was installed to facilitate the dissolving of chemicals and to prevent the formation of precipitate or changes in concentration of applied solution. Both the pressure pump and agitator were connected with the drive shaft of the truck and brought in operation by separate, conveniently located levers. The liquid was distributed through two horizontal spraying pipes with 1/16 inch nozzles. One of these pipes was mounted in a permanent position and the other on a long swinging rod, making possible the treatment of beds adjacent to overhead system line (Fig. 1).

In operation, the required amount of salts, measured by graduated scoops, is placed in the tank, and the tank is filled with water by means of a hose. The motor is started and agitator brought into action. Depending upon the nature of salts, it is either kept in operation throughout the entire treatment, or turned off after the salts are dissolved. Ordinarily in the application of soluble nitrogen-phosphate-potash fertilizer, it is sufficient to operate the propeller for a period of

[1]The writer is indebted to Prof. S. A. Wilde, University of Wisconsin, and to Henry Myron, supervising mechanic of Wisconsin Civilian Conservation Corps, for helpful suggestions and aid in construction of the described unit.

15 minutes and make application with the agitator stopped.

The sprayer is run in low gear following the paths between seedbeds, with pressure pump working, and the liquid is sprayed over two rows of seedbeds. The nozzles are arranged in such a position that the spray is delivered chiefly in between the rows of seedlings. This minimizes the danger of "burning" the stock by chemicals and decreases the amount of subsequent watering necessary for washing the chemicals off the leaves. The proper distribution of liquid is achieved by regulation of pressure, speed of the truck and, if necessary, size of nozzles. Ordinarily rate of application is fixed to deliver one gallon per 100 square feet traversed. At this rate, it is necessary to make 4 trips to distribute the required two gallons of solution over a 4 by 12 standard seedbed.

The relatively slow discharge of the liquid with 1/16 inch nozzles is believed to be desirable as the repeated spraying covers the area more uniformly. According to experience of the Wisconsin Central State Forest Nursery, the capacity of the sprayer, including refilling of the tank, is 400 standard seedbeds per hour or about 4 acres per day.

The use of the described unit has greatly decreased the cost of treatment.

Fig. 1.—Wisconsin multiple-use sprayer applying liquid fertilizer upon 2-year-old spruce seedlings.

# FORESTRY IN AUSTRALIA AND NEW ZEALAND

By MARVIN KLEMME
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This article was written while the author was on a world tour to study grazing and forestry conditions. The information was obtained from personal observation and from contacts with forestry and agricultural officials, stockmen, sawmill operators, and other citizens. He presents it solely for the interest of American foresters and not as a comprehensive report of the forestry conditions in those countries. No criticism of their policies and administration is intended or implied.

## Australia

AUSTRALIA has almost as large an area as the United States, but has a population of less than seven millions, of whom more than three-fourths live within fifty miles of the Coast. Within this relatively small area are also located Australia's commercial forests and potential forests.

Central Australia, comprising more than three-fourths of the area of the country, is hot, dry desert or semidesert. Over considerable portions of it are found scattered stands of stunted trees, usually members of the Eucalyptus family, which have some value as fuel and fence posts but have no commercial importance.

The forests then, for all practical purposes, are confined to a rather narrow strip of country, principally along the East Coast, but to a limited extent all around the Continent. The country supports about four hundred species of Eucalyptus alone, as well as a great variety of tropical or semitropical hardwoods. Although no true conifers exist naturally in the country, three or four near-conifers produce lumber similar to some of the true pines.

The so-called "oaks," "gums," "sassafras," "maple," "walnut," "beech," and "hickory" have absolutely no botanical relation to those species of the same name in America or Europe. The explanation is that when a "bushman" found a tree that produced wood that slightly resembled a beech or a walnut in the Old Country he called it a "slippery" beech or a "spotted" walnut, and the names have been commonly accepted.

Within the past thirty years or more true conifers chiefly from the United States, have been introduced with some excellent results. In the State of Victoria the principal species planted has been Monterey pine (*Pinus radiata*). More recently, experiments have been carried on with Douglas fir (*Pseudotsuga taxifolia*) and western yellow pine (*Pinus ponderosa*). The Commonwealth Territory has planted near Canberra about twenty thousand acres and has had good results with Monterey pine. In the northern part of New South Wales and Queensland, good results have been obtained with our southern pines, especially slash pine (*Pinus caribea*).

In my opinion, as well as that of some of the local foresters, the native species have been neglected in the interest in exotic conifers. Strange as it may seem, very few eucalypts have been planted, although they grow rapidly and make excellent lumber for such uses as box and crate material and even building materials. Private forestry, from a practical standpoint, does not exist in Australia except in small woodlots or windbreaks.

The two great handicaps of forestry in Australia at the present time are a serious fire hazard over much of the country, and the nonexistence of an efficient forestry organization, including forestry schools.

Australia has lately experienced one of the worst droughts as well as one of the worst forest fire seasons in her history. Much of the country has received little rain for the past three or four years. In some places the trees are dying for lack of moisture. The temperature was extremely high, running up to 130° in the interior and 114° on the Coast. On top of all this, low relative humidity and high winds occurred. According to local reports, about ten million acres of forest and brush land were burned over in the States of New South Wales and Victoria alone. It is also reported that more than one-half of the forest area and over half of the commercial timber in the State of Victoria were burned over and destroyed.

Approximately one hundred people were burned to death. Several towns were partly or completely destroyed, as well as many farm homes, sawmills, and livestock. The heat wave,

[1]Regional grazier, Division of Grazing (on leave of absence).

plus the heat from the forest fires, resulted in many deaths from sunstroke. One little town that I visited lost nineteen people from the heat within a week. Coniferous plantations suffered severely. The Commonwealth Forest of 20,000 acres near Canberra was over 30 percent destroyed and the plantations of both Victoria and New South Wales are reported to have suffered as badly. The worst damage was probably done on the Melbourne watershed in Victoria where the large "mountain ash" trees (a thin barked species of Eucalyptus) were almost completely wiped out. Many of these trees were five or six feet in diameter and rivaled the redwoods in height. In traveling by train from Canberra to Sydney one gets a good idea of the enormous losses that resulted; the charred remains of several towns and farm homes are in evidence. However, the timber along this route is not of a high quality.

From the standpoint of organization the forestry profession in Australia is under a serious handicap. The fault is not entirely with the foresters because there are many competent, conscientious, and well-trained men in their ranks. The solution of their most difficult problems therefore, rests in hands other than their own.

The Lands Department controls the Crown lands which form a much larger acreage than the "forest lands," which are all intermingled, sometimes including private holdings. Many of the "forest blocks" are so small that they are not practical administrative units. Despite the fact that much of the Crown land has heavy stands of timber, it is leased to stockmen for grazing purposes. In order to get the best use from the land the average stockman believes that he must burn it off in the autumn before the wet weather sets in. The result is that many fires get away. The forester has no authority over these Crown lands; he must wait until the fire gets on the "forest" and by that time it is frequently beyond control.

The Eucalyptus species, surprising as it may seem, present a higher fire hazard than do coniferous stands. The Eucalyptus leaves contain an oil which under heat explodes into a gas which becomes absolutely uncontrollable. Instances are reported of fires jumping three or four miles with a strong gale behind them.

Australia needs a reclassification of her lands and then an improved fire detection and suppression organization before forestry can be expected to make progress.

Much valuable hardwood timber is found in Australia and several of the wood technology laboratories are doing very good work in bringing its uses to the attention of consumers.

A few years ago representatives from the several states decided to organize a good school of forestry, which would be located in Canberra, the Commonwealth capital. A building was constructed with all the necessary equipment for the training of the students. Each state was to have the privilege of sending a certain number of "cadets" for training. Administrative difficulties developed, however, and I understand that only nine students are enrolled for the coming school year.

Forestry offers great possibilities in several sections of this country. Those foresters trained in the United States express their hope that some day there will be a national forest service in Australia similar to that which exists in the United States.

## New Zealand

New Zealand is about the size of the State of Colorado. It lies about a thousand miles southeast of Australia and has approximately one and one-half million inhabitants. Most of the country receives from 40 to 60 inches of rainfall annually, which is well distributed throughout the year. The temperature seldom falls below freezing except in some of the higher country on the south island. Therefore, because of the unusually favorable climatic conditions, much of the country is adaptable to intensive pasturage of livestock.

Most of the original forest cover has been removed. Land was cleared by slashing the undergrowth and cutting a limited amount of the larger timber, while the remainder was "ringbarked." In dry weather the area was burned over and grass seed sown in the ashes.

The level and rolling lands serve a higher use as pasture than they did, or would, in forest cover, but thousands of acres of steep hillsides were also cleared in this manner. Now, most of the grazing lands in New Zealand have a high carrying capacity if they are handled properly, but if they are not handled properly they "go back" quickly.

This small country raises about 31,000,000 sheep as against 54,000,000 for the entire United States. Since the soil produces principally a coarse grass, and, since sheep will not eat a coarse grass except when it is young and tender, it is necessary to keep the pastures eaten down

at all times. Hence, all sheepmen find it necessary to run some cattle, usually dairy stock, even though they are frequently run at a loss. This combination of livestock, and rotation of pastures, worked out well on all but the steeper areas. On many of the mountainous areas the country was too steep and rugged for cattle to get over and, since the sheep were unable to keep the pasture under control, the result was that in a comparatively short time the lands were overrun with ferns, briers, and various kinds of undesirable brush. In this condition such areas are of no value whatever.

Originally, New Zealand supported only those species known as tropical or semitropical hardwoods. There were no true conifers and even species of the Eucalyptus family were nonexistent. The large areas of valuable native species were largely cleared to make way for pastures. The result is that this country is very short of timber and must import considerable quantities.

There are probably few countries in the world where commercial forestry is more practical. The fire hazard is very low, the rate of growth is high, and the market for almost all kinds of forest products is good. Strange as it may seem, the species that seems to offer the best possibilities is Monterey pine (*Pinus radiata*) a tree that is regarded pretty much as a weed species in the United States. This species, as well as several others, was brought over to New Zealand seventy-five years ago and planted in windbreaks. The rate of growth and quality of the wood were such that foresters began to see the possibilities of growing the species on a commercial basis.

Shortly after the World War private companies were formed and a considerable acreage was planted. A number of other coniferous species were also, and are still being tried out. Fairly good results have been obtained with some of the Eucalyptus species, although the wood is not as valuable as that of the pine. Mixed plantings of pine and Eucalyptus have been tried out with fair results. I visited one mixed planting which was thirteen years old, and I measured several pines that were sixteen inches d.b.h. Although none of the eucalypts measured so great a diameter, many of them were beginning to overtop the pines in height.

In addition to a rather limited area of the original forest, the government is planting a small acreage each year principally to Monterey pine. The results achieved are satisfactory as far as they go, but they are far too limited in scope. New Zealand has many thousands of acres of land which are ideally suited to the growing of timber and nothing else. The need for timber is going to increase greatly within the next few years for many of the homes, which were constructed from timber from the original stands, are reaching the point where they need to be repaired or even replaced. Furthermore, the population is increasing, and the country is quite capable of supporting in comfort three times the number it now has. An increase in population is bound to increase the need for forest products.

The forestry educational facilities are inadequate. Such forestry as is now taught is a sort of side line of agriculture. The forestry possibilities and needs of this country apparently justify the establishment of a good school of forestry.

### New Brunswick Forest Resources

ALMOST 80 percent of the land area of New Brunswick is forested. The productive forests, containing merchantable timber and young growth of prospective value, are estimated at 21,773 square miles, and only 189 square miles are classed as nonproductive forests. Of the productive forests, 10,682 square miles are Crown lands, and 11,091 square miles are granted or private land. The total estimate of merchantable timber amounts to 11,089 million cubic feet, about two-thirds of which are softwoods, mainly spruce, balsam, cedar, and pine, and one-third hardwoods, mostly birch and maple. The average annual cut during the past thirty years has been about 150 million cubic feet, consisting of some 125 million cubic feet of softwood and 25 million cubic feet of hardwood.

# SOME EFFECTS OF THE 1936 DROUGHT ON THE FOREST AT THE CLOQUET FOREST EXPERIMENT STATION

By T. SCHANTZ-HANSEN and PHILIP N. JORANSON
*University of Minnesota*

The relationship between weather conditions and the growth of trees always has been of great interest to foresters, but it has not been investigated with sufficient accuracy or thoroughness to enable an understanding of the many puzzling growth phenomena which are often observed. Correlations have been demonstrated between weather conditions and growth in both height and diameter. While no attempt has been made in this paper to review the extensive and well known literature on this subject, it is of interest to note that, in general, the best correlations have been secured when the particular factor investigated was a limiting factor.

THE extreme drought of the summer of 1936 afforded an excellent opportunity to observe the reaction of the forest and of individual trees to the particularly unfavorable conditions of that year. Observations of drought effects on stands as units and on individual trees growing on the Cloquet Forest and in adjacent stands were made in September 1936 and checked again in September 1937 for additional evidence of drought damage.

The Cloquet Forest as a whole experienced very little drought injury. Examination was made of numerous specimens of the three native pines—jack pine (*Pinus banksiana*), Norway pine (*P. resinosa*), and northern white pine (*P. strobus*)—occurring along several compass lines which were run in Norway pine and northern white pine plantations and in stands of natural reproduction. On every tree of each of the three pines, it was observed that the 1936 needles were much shorter than the needles produced in previous years. Since it seemed entirely possible that a similar, but less apparent, reduction in needle length might also have occurred in the cases of the black spruce (*Picea mariana*) and balsam fir (*Abies balsamea*), collections of 1935 and 1936 needles from all five species were made in order to determine differences in length, diameter, and surface area. From the standpoint of precipitation, the 1935 growing season was much more nearly normal, and it was thus convenient to assume that the needles produced in that year were of approximately normal dimensions, and to use them as standards with which to compare the 1936 needles.

## Weather and Soil Moisture Conditions during the 1935 and 1936 Growing Seasons

The 1936 growing season was the most unfavorable one of the 26-year record of continuous weather observations at the Cloquet Forest Experiment Station. Temperatures were higher than ever before recorded. During one period in July when no rainfall greater than 0.02 inch fell for 20 days, maximum temperatures varying from 100° F. to 105° F. were recorded on 8 successive days. The monthly averages for the growing season appearing in Table 1 make it clear that the season was much drier and warmer than both the 25-year normal and the 1935 growing season. For the purpose of this study, the growing season was dated from May 11 to August 31.

It is well recognized that all rainfall is not available to the vegetation, and also that the distribution of rainfall may have as great an effect as the total amount on the development of the plant. Voorhees[1] in studying effective rainfall found that .10 inch of each day's rainfall was immediately evaporated. This amounted to approximately 20 percent of the total rainfall during the growing season. The rainfall of each day must thus exceed .10 inch in order to allow any excess for transpiration and growth, seepage, and run-off. Voorhees also computed the percentages apportioned to these other "fates" of rainfall, but since the vegetation and topography of the region studied by him are quite different from the vegetation and topography at Cloquet, these percentages cannot be applied here.

The total precipitation for the 1936 growing season was 6.02 inches, which is only 47 percent of normal. In order to secure an estimate of "effective" precipitation, Voorhees' 20 percent reduction factor was applied to the 6.02 inch total, yielding an "effective" rainfall of 4.82 inches. When .10 inch was deducted from each storm, the "effective" rainfall was only 3.89 inches. The

[1]Voorhees, J. F. Further study of effective rainfall. U. S. Mo. Weather Rev. 54: 332-336. 1926.

total secured in this way represents a rather large departure from the total of 4.82 inches secured by the first method, but when the rainfall for the wetter 1935 season was retotaled by these two methods, the values for "effective" rainfall were 13.82 and 13.92 inches, respectively. These results suggest that Voorhees' reduction factor may apply best in cases where the precipitation is normal or above.

Kittredge[2] in his studies of forest planting in the Lake States found that the occurrence of ten-day drought periods and temperatures of 90° F. and above influence the survival of plant trees. It is reasonable to expect that these same conditions might influence the growth and behavior of established trees as well. In 1936, there was one such period of eleven days between June 6 and June 17, another period of twelve days between June 17 and June 29, still another period of twenty-one days between July 1 and July 22, and a final period of twenty-three days between July 26 and August 18. These amount to the equivalent of six ten-day periods of extremely adverse growing conditions. It should be further emphasized that the storms dividing these drought periods did not bring an abundance of precipitation. On July 17 only 0.20 inch fell; on June 29 there was 0.52 inch; on July 22 the rain amounted to only 0.18 inch; and the August 18 rain contributed only 0.25 inch. Except in the case of the 0.52 inch precipitation on June 29, it is doubtful whether any of the storms had a great deal of effect upon the growth of the vegetation.

From these records it is quite obvious that the 1936 drought was an extremely severe one. The high temperatures and the low humidity tended to increase transpiration at a time when the moisture in the soil was barely sufficient to maintain the vegetation. The leaves of much of the subordinate vegetation, both herbaceous and woody, became permanently wilted. Studies of soil moisture made during the season in a fairly dense stand of Norway pine reproduction yielded minimum values of 3.57 percent for the first 6 inches, 3.78 percent from 6 to 12 inches, and 2.81 percent from 18 to 24 inches.[3] When these percentages are compared with the wilting percentages computed for each of the three depths—3.0 percent, 2.1 percent, and 1.7 percent, respectively—it is apparent that the minimum at each depth very nearly approached the point at which permanent wilting sets in.

### Investigations in Forest Stands

In order to observe drought effects in the forest, several compass lines were run in a 1913 northern white pine plantation, a 1925 Norway pine plantation, and a twenty-five-year old stand of Norway pine natural reproduction.

In the northern white pine plantation growing on Munger fine sandy loam, a sample strip 14 chains long revealed no observable effect other than a very pronounced reduction in the length of the needles of the current year. The same effect was observed in the eleven-year old Norway pine plantation on Omega loam medium sand, and in the fairly heavy stand of twenty-five-year old natural reproduction of Norway pine, where it was also noted that the number of brown needles was abnormally large, and the needle fall had been unusually heavy. The latter stand and an adjacent one of mature Norway pine which exhibited similar drought effects were both located on Omega loam fine sand. The presence of an abnormally large number of brown needles, and the occurrence of an unusually heavy needle

Table 1.—Monthly Precipitation and Temperature Records of the Cloquet Forest Experiment Station for the 1936 Growing Season

| Month | Precipitation | | | Mean maximum temperature | | | Mean minimum temperature | | | Mean temperature | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Normal[1] | 1935 | 1936 | Normal[1] | 1935 | 1936 | Normal[1] | 1935 | 1936 | Normal[1] | 1935 | 1936 |
| | *Inches* | *Inches* | *Inches* | *°F.* | *°F.* | *°F.* | *°F.* | *°F.* | *°F.* | *°F.* | *°F.* | *°F.* |
| May 11-31 | 2.19 | 1.84 | 1.62 | 67.1 | 66.6 | 74.4 | 37.4 | 34.7 | 42.1 | 52.3 | 50.6 | 55.4 |
| June | 3.98 | 4.92 | 1.16 | 74.1 | 69.6 | 73.3 | 46.5 | 45.6 | 43.9 | 60.2 | 57.6 | 58.6 |
| July | 3.43 | 5.78 | 0.54 | 79.8 | 83.4 | 88.9 | 50.9 | 57.8 | 53.5 | 66.6 | 70.6 | 71.3 |
| August | 3.09 | 4.83 | 2.70 | 77.2 | 76.0 | 79.8 | 49.6 | 54.0 | 53.0 | 66.0 | 65.0 | 66.3 |
| Total | 12.69 | 17.27 | 6.02 | | | | | | | | | |

[1]Based on 25 years of continuous records.

[2]Kittredge, J., Jr. Forest planting in the Lake States. U. S. Dept. Agric. Bull. 1497. 1929.

[3]These determinations were made by H. K. Cheo.

fall were apparently typical of all Norway pine stands, whether young or old. Elsewhere in the Cloquet Forest on the same type of soil occasional black spruces growing on high ground were found with drooping current year's shoots.

While the Cloquet Forest as a whole thus showed very little apparent evidence of drought damage, there were numerous instances in the surrounding country where considerable portions of stands had been drought killed. A striking instance of heavy damage was found in a stand located just east of the city of Cloquet. The stand is a mixture of Norway and northern white pine with a few scattered balsam firs and black spruces. It occurs on the very thin soil found in the rock outcrop area along the St. Louis River. The stand is rather open, averaging 400 to 500 trees per acre. These are irregularly distributed because of the presence of rock ledges. The stand is even-aged at approximately 40 years and ranges from 4 to 8 inches d.b.h., with heights from 30 to 40 feet.

During the drought season and immediately following there was no apparent evidence of injury in this stand, but early in the fall after growth had stopped, a considerable portion of the stand turned brown in an almost unbelievably short time.

A more detailed examination of this stand was made in September 1937. The most striking feature of the damage was that a large majority of the drought-killed trees were Norway pines. Three tenth-acre plots were laid out in typical portions of the stand, and the total numbers of dead and living trees were recorded.

The total stand per acre on the three plots averaged 410 trees, of which 227 or 55 percent were northern white pine, 177 or 48 percent were Norway pine, and the balance balsam fir and black spruce. Fifty, or 21 percent of the total number of northern white pine, and 16, or 92 percent of the total number of Norway pine, were killed by the drought. A loss of 52 percent of the entire stand indicates a very severe drought damage.

While these three plots are not sufficient to give statistically accurate percentages, they serve, nevertheless, to indicate the extent of the damage and the species involved. The Norway pine, a tree accustomed to much drier and sandier soils, suffered the heaviest losses. An apparent explanation of this rather paradoxical condition comes to mind. As already has been stated, the stand occurs on scantly soil covering a rock outcrop. During the forty years of the stand's existence it doubtless has been subjected to several periods of drought less severe than the one occurring in 1936. These droughts would probably tend to eliminate a larger proportion of northern white pine than of Norway pine on the scantier and drier soils. Because the Norway pines apparently possessed sufficient resistance to survive the minor drought periods, there were more trees of this species left on the poorer locations to succumb to the extreme drought of 1936; hence, the high mortality of Norway pines.

This instance of drought damage was of course limited to a few acres. Many other similar instances could probably be found, but such severe injury fortunately did not occur over extensive areas in northeastern Minnesota. A record of the case should be of considerable value because it presents an account of the type of damage that may be caused by adverse weather conditions under circumstances which may be duplicated at some future time.

## The Effect of the Drought upon the Surface Area of the Needles of the Native Pines

In order to check the general observation of reduction in needle length, ten young trees of each of five species—jack pine, Norway pine, northern white pine, balsam fir, and black spruce—growing within 400 yards of the arboretum and upon the same soil as that found in the arboretum were selected. From each tree fifty individual needles or bunches of needles (depending on whether needles were produced singly or in clusters) were picked from the 1936 growth, and samples of the same size were taken from the 1935 growth. One needle was selected at random from each cluster of jack, Norway, and white pine needles, and the rest were discarded. This left a sample of 500 individual 1936 needles and another of 500 individual 1935 needles for each of the five species.

It was concluded from the magnitude of variation in length of the first several hundred needles measured that 200, rather than 500, would be an entirely adequate sample size even for the two species in which only a small difference was expected. Accordingly, 200 needles were selected at random from each group of 500 needles, and the remainder discarded. The average lengths appearing in Table 2 are thus each based on the

measurement of 200 needles. Since the average lengths of the balsam fir and black spruce needles were almost equal for the two years no diameter measurements were made on the needles of these two species.

Before there was time to measure diameters,[4] the needles in these samples had dried to such an extent that it was necessary to obtain fresh samples, and on November 28 the diameters of needles of the three pines collected on the day preceding were measured with an eyepiece micrometer under low power of the microscope. The needles obtained for diameter measurement came from several trees in the same stand from which the previous collection had been made.

The following procedure was used in selecting and measuring the diameters of the 1935 and 1936 needles of all three pines:

1. Fifty clusters of needles were picked from the four or five branches collected.

2. These clusters were well mixed together, 25 were selected at random, and the remainder were discarded.

3. One needle was picked from each cluster and the remainder were discarded.

4. From 5 to 10 very thin cross-sections were made as nearly as possible in the middle of the needle by a quick, sliding cut made with a razor blade.

5. These sections were laid flat on a slide and placed under low power of the microscope.

6. The dimension, *R*, was measured on two of the cross-sections by means of an eyepiece micrometer.

7. Both measurements were recorded and the smallest one struck out, since the larger measurement is a better approximation of the true diameter.

The *t* test was used to determine whether the average differences in length and diameter of needles were statistically significant. Needle areas were computed according to the formulas given, and percentage differences between the 1935 and 1936 values were calculated. The results of all the computations leading to the determination of differences in needle areas have been brought together in Table 2.

The very large *t* values of the differences between mean lengths of 1935 and 1936 needles of northern white, Norway, and jack pines leave no doubt that needle length was in these species significantly affected by the drought conditions. That the reduction in needle length was actually due to the extremely adverse growing conditions attendant upon the drought is indisputable; no other factor could possibly have accounted for more than a very small portion of the observed reduction in length.

For black spruce, the 1936 mean was slightly greater than the 1935 mean, but the difference between the mean lengths was far from significant. The 1936 balsam fir needles were also larger than the 1935 needles, and the *t* value, 2.624, slightly exceeded the 2.588 one percent probability level, indicating high significance. There is some indication that balsam fir needles may require a much shorter period than the pines to complete their growth, and would therefore benefit more from any excess precipitation which occurred before the growing season was well under way. They would also suffer less from any deficiency later in the season. The precipitation records seem to substantiate this explanation, since the total precipitation for the period of May 1 to June 10, inclusive, was 6.29 inches in 1936 and 4.64 inches in 1935. It seems quite likely that black spruce growing on upland soils may behave much as the balsam fir.

The 1936 needles of all three pines were smaller in diameter than the 1935 needles, but the difference in mean diameters was highly significant only in the cases of white and Norway pines. In jack pine, the differences were far too small to indicate significance.

The formulas used in the calculation of the mean needle surface which appear in Table 2 yield only approximate values and give different results depending upon the shape of the needle,

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[4]When viewed in cross-section, the needle in its cluster is considered as a sector of a circle in both the two-needle and five-needle types. "Diameter," as used here and in the following discussion, refers to the dimension, *R*, which is the radius of this circle measured in such a way that it bisects the sector formed by a single needle. The measurement is taken at a point half way between the tip and the base of the needle. The surface area of white pine needles is computed according to the formula,

$$\text{surface area} = \text{average length} \left( \frac{2 \times 3.1416 \times \text{av. } R}{5} + 2 \times \text{av. } R \right)$$

For Norway pine and jack pine, the formula used is: surface area = average length (3.1416 x av. $R$ + 2 x av. $R$). The former formula is a modification applicable to five-needled pines. The latter formula has been used by Korstian, et al. (Korstian, C. F., et al. A chlorosis of conifers corrected by spraying with ferrous sulphate. Jour. Agric. Research 21: 153-171. 1921).

which, of course, varies from species to species. These limitations are not, however, of great importance when the differences vary as much as is shown in Table 2. The reduction in needle area of jack pine was occasioned largely by the decrease in length, for the diameters were almost the same. Since it is quite likely that the number of stomata decreased in rough proportion to the total surface area, a reduction in needle area is obviously an advantage to the drought-besieged tree.

Measurement of needle lengths on four trees in the stand east of Cloquet were taken to provide a rough check on the measurements from trees on the Cloquet Forest. Two northern white pines, one showing an extreme effect on needle length and the other exhibiting approximately average 1936 needles, and two similarly chosen Norway pines were selected. The 1936 needles were compared with the 1937 needles growing on the same twig because the 1935 needles had fallen and were therefore not available for comparison. The 1937 weather conditions were much more nearly normal than those of 1936. Total precipitation during the growing season (as recorded at the experiment station, which is five miles from the drought-injured stand) was 13.32 inches, as compared with the normal total of 12.69 inches.

The greatest difference in length between the 1936 and 1937 needles was 4.14 cm. for northern white pine and 12.07 cm. for Norway pine. The average difference, based on ten measurements from different trees, was 3.17 cm. for northern white pine and 7.63 cm. for Norway pine. This indicates that needle length was reduced to a greater degree in this stand than on the Cloquet Forest.

## Summary

The investigation was undertaken to observe and describe the various effects of the extremely severe drought of 1936 upon coniferous stands in and near the Cloquet Forest. The differences between the average surface areas of the needles of the native jack, Norway, and northern white pines produced in 1936 and those produced during the more normal growing season of 1935 were, without exception, found to be highly significant.

The length, and probably also the surface area, of balsam fir and black spruce needles were not reduced as a result of the drought.

In a stand of Norway and northern white pine ranging from 30 to 40 feet in height and located on a thin soil underlain by rock, approximately half of the total number of trees and nearly all of the Norway pines were killed.

It is reasonable to suppose that such a significant reduction in leaf area would be reflected in a decrease in the rate of growth for the 1937 season as well as the 1936 season. Apparently the size and development of the needles of the three species of native pines is dependent upon the growing conditions of the year in which they are produced.

Table 2.—Measurements of Length and Diameter of 1935 and 1936 Needles, with Tests of Significance and Total Surface Area Calculations

| Species | Average needle length[1] | | | Average $R$ dimension[2] | | | Average needle area | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1935 | 1936 | $t$ value of difference between 1935 and 1936 lengths | 1935 | 1936 | $t$ value of difference between 1935 and 1936 $R$ dimensions | 1935 | 1936 | Percent reduction in 1936 |
| | *Cm.* | *Cm.* | | *Mm.* | *Mm.* | | *Sq. cm.* | *Sq. cm.* | |
| White pine | 8.08 | 5.08 | 26.270[3] | 0.490 | 0.438 | 4.111[3] | 1.2896 | 0.7244 | 43.83 |
| Norway pine | 13.61 | 9.82 | 33.170[3] | 0.720 | 0.616 | 6.307[3] | 5.0384 | 3.1100 | 38.27 |
| Jack pine | 3.60 | 2.71 | 14.834[3] | 0.488 | 0.480 | 0.383 | 0.9032 | 0.6688 | 25.95 |
| Black spruce | 0.85 | 0.86 | 0.752 | ----- | ----- | ----- | ----- | ----- | ----- |
| Balsam fir | 1.49 | 1.60 | 2.624[3] | | | ----- | ----- | ----- | ----- |

[1]Each value is the mean of a sample of 200 needles.
[2]Each value is the mean of a sample of 25 needles.
[3]Value exceeds 1 percent probability level of 2.588 for 400 degrees of freedom.

# SLASH AGAIN IN THE LAKE STATES

By E. G. CHEYNEY
*University of Minnesota*

THE slash problem in the Lake States seems to have been settled to the satisfaction of most foresters and possibly it would be best to let it lie along with the other sleeping dogs. Many foresters seem to have reached the conclusion that all slash should be piled and burned, and are resting comfortably on that decision. Now that they have won the hard battle to establish such a practice, it is undoubtedly the most consistent and also the easiest thing to do. Granting that all this is true, it nevertheless appears to the writer that it has been settled wrongly and wastefully, and he has an irresistible desire to kick the dog.

If all these convictions in regard to the nefarious nature of slash were founded upon solid data and were the result of thorough scientific investigation, there might be more reason for accepting them as gospel; but they are not. Fire burned a number of towns and countless valuable skidways. Slash happened to be there and its head fitted nicely into the goat's collar! No one has any proof that the towns and the logs would not have burned just the same if the slash had not been there.

Without a jury or any other fair trial, slash has been arbitrarily branded as a dangerous fire hazard; and that settles it. That is really the whole argument. It is said also that slash interferes with reproduction and should, moreover, be disposed of for aesthetic reasons. These arguments, however, are put forward largely for the purpose of bolstering up the accusations of dangerous fire hazard.

So far as the writer knows, no one has ever brought forward any actual data to prove that slash prevents reproduction, though impassioned but unsupported statements to that effect are often made. The writer has asked many research workers studying the important species in different parts of the country this question: "Is reproduction better where the slash is burned or where it is not burned?" The answer has usually been: "Where it is not burned!"

The aesthetic value of slash burning on clear cut lands, when carefully done, can hardly be questioned. There are few things more unsightly than a tangle of slashings. But even here it is too expensive a luxury except in the few places where tourist travel is heavy and the scenic values high.

Now for the refutation of the main argument that slash is a dangerous fire hazard and should be burned. The answer is also doubled barrelled. Slash is not nearly so dangerous a fire hazard as it is reputed to be; and the disposal of it by piling and burning is prohibitively expensive.

To take the latter argument first. It is difficult to determine an average cost for the piling and burning of slash because conditions vary so from one job to another. However, it should be readily admitted that 50 cents per thousand feet of cut is a conservative figure in the Lake States.

That does not sound like a great deal of money, but let us see what it means to the man who is logging a township of timber that runs eight thousand feet to the acre. It will cost him $4 per acre, $160 per forty, $2,560 per section, $92,160 per township. These figures are for the Lake States where the stand of timber is light. That is a lot of money to spend for the disposal of an *alleged* fire hazard that is of a more or less temporary nature.

Some years ago there was a small tract of young white pine timber on the Cloquet forest that was badly overtopped by a stand of mature jack pine. The jack pine was logged by the usual horse logging method and the slash allowed to lie where it fell. No attempt was made to dispose of it in any way.

It so happened that the logger did a very clever job of felling large jack pines without injury to the understory of white pine. Some visitors were taken to this tract six years after the cutting to show them what could be done in the felling of large trees without injury to reproduction. The tops of the felled trees *were no longer distinguishable!* They had completely lost their original form. In fact, if it had not been for the stumps it would not have been possible to find where they had been.

Spruce and cedar cut in a swamp on the Wales branch in northeastern Minnesota had ceased to be a fire hazard three years after cutting.

Many other instances of like nature could be given. It would be a conservative statement to say that no slash is a special fire hazard in the Lake States for more than five years after it is cut. If that is true, and there is much evidence to indicate that it is, the logger cited above has paid $92,160 for the protection of one township for an average period of five years—$18,432 per year. The usual fire season in the Lake States does not exceed four months. Forty-six men at $100 per month could be put on patrol for four months every year for five years for that same cost. This is obviously a ridiculous number of patrolmen. One-tenth that number would make a fire practically impossible, and at one-tenth the cost.

Or let us suppose that the advocates of slash burning attained their ideal and succeeded in getting the slash piled and burned on every acre cutover in the United States. The annual cost would not be less than $20,000,000, which is far more profit than the lumbermen of the country have seen for quite a while.

This cost of $92,160 per township, high as it seems represents slash burning under ideal conditions, that is, under clear-cutting. Where the slash is piled and burned on T. S. I. operations the cost rises to two to eight times that of clear-cut areas, or from $184,320 to $737,280 per township. Either one of those figures is a ridiculous burden with which to saddle any practical forestry operation.

Nor is this all! The value of the operation when completed is questionable. The advocates of slash burning speak of it, and apparently think of it, as a complete fire proofing process. But is it? Was the slash on any area ever so completely destroyed that a fire could not burn over that area? The question is rather definitely answered by the fire of 1918 that burned the town of Cloquet. That fire burned for miles through a country where the slash had been as carefully and as thoroughly burned as anywhere in the United States. The damage could not have been greater if the slash had been six feet deep.

The field experience of the past twenty years has raised still other doubts. Most experienced fire fighters say that they would much prefer to fight a fire in slash to one in a country covered with brush and weeds, because a fire in slash moves more slowly. To be sure, the fire burns more intensely where it is, but it is easier to handle because it does not travel so fast.

This point is not based entirely upon general observations; it can be backed to a certain extent, anyway, by scientific study. A comprehensive study was made by the Lake States Forest Experiment Station on the rate of spread of fires in different types of cover. It was not made with the idea of exonerating slash, certainly; but it brought out one piece of striking evidence in favor of leaving slash. The investigator, Russell Watson, explained that fire in slash was not included in the report because fire spread only slowly there!

The "Manual" very largely rates the damage done by a fire and the efficiency of the fire fighters on the area that a fire covers. As a fire spreads less in slash than where there is no slash, why not leave the slash and improve the fire rating?

To look at the problem from another angle for a moment. Two percent a year is a very generous estimate of the part of any tract that would burn over under normal conditions, slash or no slash. That would mean a maximum of 10 percent that might burn over in the five years during which the slash is supposed to create an extra hazard. Therefore, the most that slash burning could hope to accomplish would be the prevention of fire on 10 percent of the area. Since the cost of slash burning is $4 per acre and only one acre in ten would burn, the cost of saving that one acre would be the cost of protecting ten acres, or $40. The burned area could be planted up three times for that amount. Why not take a chance, plant up the burn, and put the balance in the cash drawer?

Of course this article is not based on very much more data than the pleas of the fire bugs; but it is certainly not based on any less. The result seems to point an accusing finger at slash burning as wasteful and incompetent. The evidence against slash burning has been convincing to the writer for many years. This article may not convince many others, but it should at least raise a question. Why not give the question some real study and settle it on its merits one way or the other?

# INCREASED GROWTH OF LOBLOLLY PINE AS A RESULT OF CUTTING AND GIRDLING LARGE HARDWOODS

By HENRY BULL

*Southern Forest Experiment Station*

A large amount of stand-improvement work has been done by C.C.C. crews during the past five or six years. In the South this work was based largely on results obtained in other regions, but substantiating data are now becoming available. A study of a loblolly pine stand in Louisiana, in which large hardwoods were cut or girdled, revealed that the basal area increased 75.4 percent on the improved plots and only 21.6 percent on the check plots, and that the pulpwood volume increased 82 percent on the improved plots and only 33 percent on the check plots. The author believes that the girdling cost has paid for itself in 5 years, and that the difference between cost and return will increase greatly as time goes on.

IF LARGE, unmerchantable, hardwood wolf-trees are girdled to benefit smaller loblolly pines beneath them, how much increase in the volume growth of the pines will occur for each man-hour spent in girdling? In the southern pine region, where timber-stand improvement has been carried out by C.C.C. crews on thousands of acres, girdling is one of the major features of the work. What actual net benefits may be obtained? If girdling is done by lumber or by pulp and paper companies, what are the possibilities for profit? A good indication of the answers to these questions was recently obtained by the Southern Forest Experiment Station from the first remeasurement of two permanent sample plots established near Urania, La., in the spring of 1933.

When the plots were established, the irregular stand of loblolly and shortleaf pines and mixed hardwoods was very definitely understocked on the whole, although small areas were overstocked. The original timber had been cut about 30 years previously, and the stand was composed principally of second-growth pines (mostly loblolly) about 25 to 30 years old, intermixed with large hold-over pines and hardwoods. Despite the generally understocked condition, three kinds of partial cuttings were needed:

1. Improvement cuttings to cut or girdle (a) large unmerchantable hardwoods that were suppressing smaller trees of desirable form and species, (b) the larger trees of unmerchantable or undesirable hardwood species, and (c) very crooked, knotty, defective, or dying pines that were nevertheless merchantable for pulpwood.

2. Thinnings to reduce the excessive crowding and competition in dense, more or less even-aged groups of second-growth pines, and to give increased growing space to selected trees.

3. Harvest cuttings to remove mature or overmature merchantable trees, in order to cash in on their present value and to make room for reproduction.

Two 2-acre plots were established in this stand in the spring of 1933. One plot was left untouched as a check, and the other, separated from it by a one-chain isolation strip, was given a general improvement cutting that included the three kinds of cuttings described above. A brief summary of the volumes per acre cut and left on the improved plot, the volume per acre on the check plot, and the annual volume growth per acre for the 5-year period, is given in Table 1, which is presented merely as a background for the discussion of the results of the improvement cuttings described under 1 (a) and (b) above.

A separate study was made of the growth and mortality of all pines within 15 feet of hardwoods more than 9.5 inches d.b.h.; and the following discussion is confined to these particular trees, which occupy approximately half the entire area of each plot. A comparison of the growth and mortality of these pines on the two plots is a good indication of the effect of removing or killing the large hardwoods, as distinguished from other phases of stand improvement. The pines removed from the stand were so distributed that they probably had very little influence on the pines within 15 feet of the large hardwoods, and this slight influence was probably more than counterbalanced by the effect of the large hardwoods on the growth of pines more than 15 feet away and not included in this special study.

On the improved plot, the hardwoods more than 9.5 inches d.b.h. were either cut into sawlogs or girdled, and on the check plot the cor-

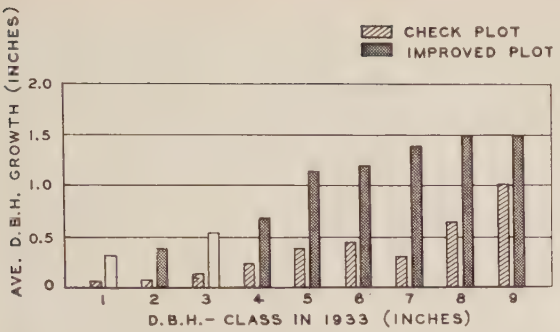


Fig. 1.—Average d.b.h. growth in 5 years of loblolly pines alive in 1938.

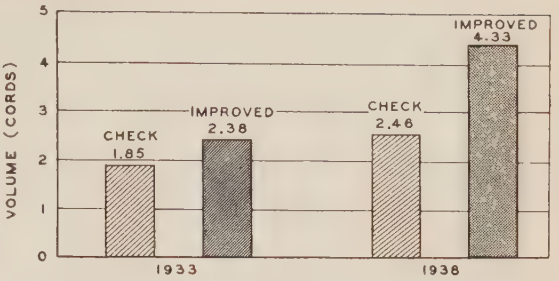


Fig. 2.—Total pulpwood volumes in 1933 and in 1938.

responding hardwoods were, of course, left untouched. Only 2 of the 40 large hardwoods on the improved plot were suitable for sawlogs; the remaining 38 were girdled.

Many of the girdled trees could have been cut for crossties, but at the time of the cutting the stumpage value for ties was so low, and the probable damage to young pines from felling these hardwoods so great (because of the large, spreading crowns, typical of wolf-trees), that it was considered best to girdle the large hardwoods that were unmerchantable for sawlogs. There was no local market for chemical wood. The hardwoods cut into sawlogs were a 19-inch red gum and a 24-inch southern red oak. The 38 girdled trees included post, southern red, swamp red, willow, and white oaks, red and black gums, and winged elm. They ranged in d.b.h. from 10 to 27 inches (average, 17.4 inches) and were girdled in 2 hours by a relatively inexperienced man who made a single row of hacks around each tree. The 39 comparable hardwoods on the check plot were of similar size and species.

The single-hack girdling, difficult to check for completeness, failed to kill only two trees. These trees callused over the girdle in several places, and in order to kill them the calluses had to be cut through about a year later. Four trees either fell while being girdled or were killed by slash fires set at their base soon after girdling. The remaining 32 trees died more or less gradually, as indicated by their rate of mortality, which may be summarized as follows:

5 ( 16 percent) were dead in 15 months,
28 ( 87 percent) were dead in 28 months,
32 (100 percent) were dead in 38 months.

Five years after girdling, 8 (25 percent) of these trees were on the ground; 10 (31 percent) were reduced to a stub, without limbs; 9 (28 percent) were reduced to a snag with less than six large limbs; and 5 (16 percent) were reduced to a snag with more than six large limbs.

The damage done by the more or less gradual disintegration and falling of the girdled trees was relatively slight, and damage figures have not been summarized separately. A few small pines were knocked down, and the tops were broken out of several more.

Each pine within 15 feet of a hardwood more than 9.5 inches d.b.h. was tagged in 1933, and its d.b.h. was recorded. All of these pines were loblolly. Enough heights were measured to make a good height-over-diameter curve for each plot.

Table 1.—Volume and growth per acre on check and on improved plots

| Plot | 1933 | | | 1938 | | | 1933-1938 Annual growth rate | | |
|---|---|---|---|---|---|---|---|---|---|
| | Pines | | Hardwoods | Pines | | Hardwoods | Pines | | Hardwoods |
| | *Bd. ft.*[1] | *Cords*[2] | *Bd. ft.*[1] | *Bd. ft.*[1] | *Cords*[2] | *Bd. ft.*[1] | *Bd. ft.*[1] | *Cords*[2] | *Bd. ft.*[1] |
| Check | 3,726 | 8.0 | 0 | 5,123 | 9.4 | 0 | 279.4 | 0.28 | 0 |
| Improved | | | | | | | | | |
| Cut | 945[3] | 3.5[3] | 272 | 0 | 0 | 0 | --- | --- | |
| Residual | 2,405 | 4.9 | 0 | 4,204 | 6.4 | 0 | 359.8 | 0.30 | 0 |
| Total | 3,350 | 8.4 | 272 | 4,204 | 6.4 | 0 | | | |

[1]International ¼-inch rule for merchantable trees 9.6 inches d.b.h. and larger.
[2]Standard cords, for merchantable pines 4.6 to 9.5 inches d.b.h.
[3]One 10-inch tree was too poor for sawlogs and was cut into pulpwood.

The number and distribution by diameter-classes of these overtopped pines in 1933 were very similar on the two plots, as shown in Table 2, which also shows the stands in 1938 and the growth from 1933 to 1938.

From this table it has been calculated that the basal area increased 36.0 percent on the improved plot but decreased 1.3 percent on the check plot. Considering only the pines of pulpwood size (4.6 inches d.b.h. and larger), the basal area increased 75.4 percent on the improved plot, and only 21.6 percent on the check plot. Mortality during the 5-year period amounted to 9.3 percent of all the pines and 1.9 percent of the pulpwood-sized pines on the improved plot; on the check plot these figures were 28.8 percent and 1.7 percent, respectively. Thus there was essentially no difference in the mortality of pulpwood-sized pines on the two plots, but there was a very striking difference in their increase in basal area. Figure 1 shows graphically the average growth in each diameter-class on each plot.

In actual pulpwood volume, the improved plot increased 82 percent and the check plot only 33 percent. Table 2 shows the distribution of pulpwood volume on the two plots, and Figure 2 shows the total pulpwood volumes in 1933 and in 1938. After adjusting for the slightly different pulpwood volumes in 1933, the improved plot produced 1.04 more cords of pulpwood during the 5-year period. This increased volume applies, of course, only to about half the total area, i.e., the area within 15 feet of large hardwoods, and accounts for the major effect of the girdling and cutting of large hardwoods, as distinguished from other phases of stand improvement. As already noted, the girdling actually required only 2 man-hours, although this requirement might be increased about 15 percent, or to 2.3 man-hours, to allow for somewhat more careful and thorough work, and to allow for the

TABLE 2.—STAND, VOLUME, AND GROWTH DATA FOR LOBLOLLY PINES WITHIN 15 FEET OF HARDWOODS MORE THAN 9.5 INCHES D.B.H. ACTUAL VALUES FOR 2-ACRE PLOTS

| 1933[1] | | | | 1933 to 1938 | | | | 1938 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| D.b.h. | No. of trees | Basal area | Volume | No. of trees that died | Av. d.b.h.-growth of trees that lived | Increase in d.b.h.-growth over check plot: Actual | Increase in d.b.h.-growth over check plot: Percent | D.b.h. | No. of trees | Basal area | Volume |
| *Inches* | | *Sq. ft.* | *Cords* | | *Inches* | *Inches* | | *Inches* | | *Sq. ft.* | *Cords* |
| | | | | | IMPROVED PLOT | | | | | | |
| 1 | 34 | .250 | .... | 7 | .322 | .255 | 381 | 1 | 14 | .115 | .... |
| 2 | 76 | 1.777 | .... | 14 | .358 | .288 | 412 | 2 | 56 | 1.369 | .... |
| 3 | 88 | 4.455 | .... | 5 | .529 | .411 | 348 | 3 | 56 | 2.801 | .... |
| 4 | 50 | 4.186 | .... | 1 | .663 | .442 | 200 | 4 | 61 | 5.318 | .... |
| 5 | 18 | 2.372 | .28 | 1 | 1.118 | .754 | 207 | 5 | 36 | 4.635 | .52 |
| 6 | 9 | 1.723 | .27 | .... | 1.178 | .747 | 173 | 6 | 12 | 2.319 | .39 |
| 7 | 8 | 2.122 | .43 | .... | 1.362 | 1.076 | 377 | 7 | 11 | 2.906 | .57 |
| 8 | 14 | 5.023 | 1.10 | .... | 1.457 | .824 | 130 | 8 | 6 | 2.063 | .46 |
| 9 | 3 | 1.348 | .30 | .... | 1.467 | .467 | 47 | 9 | 10 | 4.542 | 1.08 |
| | | | | | | | | 10 | 8 | 4.224 | 1.00 |
| | | | | | | | | 11 | 2 | 1.332 | .31 |
| Total | 300 | 23.256 | 2.38 | 28 | | | | | 272 | 31.624 | 4.33 |
| | | | | | CHECK PLOT | | | | | | |
| 1 | 16 | .135 | .... | 13 | .067 | | | 1 | 2 | .019 | .... |
| 2 | 67 | 1.558 | .... | 34 | .070 | | | 2 | 29 | .637 | .... |
| 3 | 94 | 4.710 | .... | 32 | .118 | | | 3 | 53 | 2.631 | .... |
| 4 | 51 | 4.449 | .... | 3 | .221 | | | 4 | 55 | 4.840 | .... |
| 5 | 34 | 4.554 | .54 | 1 | .364 | | | 5 | 28 | 3.695 | .48 |
| 6 | 13 | 2.535 | .42 | .... | .431 | | | 6 | 21 | 4.169 | .76 |
| 7 | 7 | 1.814 | .36 | .... | .286 | | | 7 | 11 | 2.984 | .60 |
| 8 | 3 | 1.075 | .24 | .... | .633 | | | 8 | 1 | .376 | .08 |
| 9 | 3 | 1.308 | .29 | .... | 1.000 | | | 9 | 3 | 1.337 | .30 |
| | | | | | | | | 10 | 1 | .535 | .11 |
| | | | | | | | | 11 | 1 | .624 | .13 |
| Total | 288 | 22.138 | 1.85 | 83 | | | | | 205 | 21.847 | 2.46 |

[1]For the improved plot, the values given represent the stand after the cutting.

two trees actually cut into sawlogs rather than girdled. The effect of girdling for the first 5 years, therefore, has been to bring about an increased growth of about one-half cord per man-hour of girdling.

Using only 50 cents per cord for pulpwood stumpage, 25 cents per hour for the cost of girdling, and ignoring the small interest on this cost, the girdling has paid for itself in 5 years. The use of other values and costs, and the inclusion of interest charges, will change this specific result but not the general picture. The pines near the girdled hardwoods will continue to gain volume rapidly, while the pines near the ungirdled hardwoods will gain very slowly for a while and then decrease in volume. The differences will increase greatly as time goes on, but they are already so striking that it has seemed worth-while to summarize the facts to date.

# THE SOLVENT DISTILLATION METHOD FOR DETERMINING THE MOISTURE CONTENT OF FOREST LITTER

By CHARLES C. BUCK and JOHN E. HUGHES

*California Forest and Range Experiment Station*[1]

The moisture content of plant products is commonly determined by drying them in an oven at a certain temperature for a certain period of time. It has long been known that under ordinary conditions various errors are inherent in this method. The clearly demonstrated relationships between forest fire behavior and fuel condition have focused attention on the need for a quick and accurate method for determining the moisure content of forest fuels. Such a method is described by the authors of the following article.

MOISTURE content of the fuel is one of the important factors influencing the inception and rate of spread of forest fires. Intensive studies of fire behavior and of weather and fuel relationships, which have as their common objective an improvement in fire-control technique, require the accurate measurement of this factor. The measurements must be accurate in that they must consistently yield repeatable results, although it is not essential that these results represent the true or absolute moisture content of the material tested. In fire behavior studies at the California Forest and Range Experiment Station, the satisfactory correlation of fuel moisture content with the weather elements by which it is governed, and its correlation with the various elements of fire behavior, have been found to require the detection of moisture content variations of less than 0.5 percent.

In order to serve the needs of intensive fire behavior studies which necessitate the routine measurement of fuel moisture, the method employed should not only be accurate; it should also be rapid, for much of the value of moisture determinations is dependent upon availability of the results within a short time after the samples are collected. There is also a need in this work for an easy and reliable method to provide a standard of comparison for moisture results. Such a standard would permit individual investigators to check the consistency of their own data and allow better interpretation of data obtained by different investigators working in allied fields.

## Failure of the Oven Drying Method

The commonly accepted method of determining the moisture content of vegetation samples in forest research, employing drying ovens and the computation of moisture content as a percentage of oven-dry weight of a sample, has been used exclusively in the past in fire studies at the California Forest and Range Experiment Station. Because of certain inherent difficulties peculiar to the method, it has not proved satisfactory for the determination of small but nevertheless significant changes in fuel moisture content.

Observations conducted during routine moisture determinations with a 25 cubic foot, forced-convection drying oven indicated that the results obtained were significantly influenced by the relative humidity of the air surrounding the oven and by the location of samples in the oven, apparently as a result of temperature gradients

[1]Maintained at Berkeley, Calif., in cooperation with the University of California.

in different parts of the oven. Quantitative determination of the extent of the variations properly attributable to these factors was carried out by measurements subsequently made on the influences of oven temperature, room relative humidity, and length of the drying period upon the moisture content of ponderosa pine needle litter.

The effects thus determined of time and oven temperature upon the indicated moisture content[2] of a typical sample are illustrated in Figure 1. The data are derived from frequent weighings of different samples suspended in the oven from an analytical balance for each temperature run[3] during a period of nearly constant room temperature and humidity. The samples dried at the three higher temperatures continued to lose weight at the rate of approximately 0.1 percent per day, while the sample dried at 75 degrees C. apparently approached a state of equilibrium at about 120 hours after start of drying. The continued loss in weight of the samples dried at the higher temperatures is probably caused by decomposition of the litter material (*5*) or to the loss of volatile constituents other than water or both (*2*).

At the end of the 75° run, the room relative humidity was varied artificially to determine the influence of humidity upon drying-oven results. The reaction of the sample in terms of indicated moisture content is illustrated in Figure 2. The oven temperature was raised to 86°, 95°, and 106°C. successively, following each rise and fall in humidity and consequent response in the indicated moisture content of the sample.

Routine moisture determinations are frequently made under even more widely fluctuating humidity conditions than those indicated, and the oven in use was found to have temperature gradients in different parts as large as 10°C. The errors caused by these variations could be eliminated, but only with a serious decrease in the oven capacity for routine work. Following a thorough investigation of the field, the oven-drying method was replaced by the solvent distillation method for routine moisture determinations because the latter gave the most promise of satisfying the requirements for speed and accuracy.

### The Distillation Method and Procedure

One adaptation of the distillation method was used experimentally by the Forest Service for the determination of moisture in creosoted wood as early as 1908 (*3*). Since that date there have been various adaptations of the method in various fields (*4, 6, 8*) with continued improvement in apparatus and technique. Probably the most important advance was made by Dean and Stark (*4*) with their development of a reflux distillation apparatus subsequently improved by Bidwell and Sterling (*2*) of the U. S. Bureau of Chemistry.

The method is based upon the principle (*7*) that the boiling characteristics of a liquid are changed when it is boiled in mixture with another liquid with which it is immiscible. The principal characteristics of such a boiling mixture that make it adaptable to the determination of moisture content are: 1, each of two immiscible liquids exerts its own vapor pressure, causing the mixture to boil at a temperature lower than the boiling point of either liquid; 2, the distillate condensed from the vapors produced by the boiling mixture is composed of immiscible and readily separable quantities of water and solvent, permitting the measurement of the actual volume of water removed from the sample; and 3, the governing condition at which the process is carried to completion—the boiling temperature of the solvent—is independent of all external physical conditions except atmospheric pressure.

In the application of this principle to the determination of moisture content, a sample is distilled in an extraction flask with some solvent immiscible with water. Upon heating to the boiling temperature of the mixture, water in the sample is driven off as steam and is carried with the solvent vapor into a suitable condenser where both are condensed to liquid and flow into a graduated receiver. Because of its higher specific gravity the water sinks to the bottom of the receiver where it forms a measurable layer beneath the solvent.

Some investigators (*3*) have described methods employing conventional distillation in which both the water and solvent accumulate in the receiver during the entire distillation process.

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[2]When a sample is subjected to a drying process it loses weight and when it is removed from the apparatus and weighed, the weight obtained is termed "dry weight" and the loss in weight occasioned by drying is considered as water. Since the dry weight obtained is not constant, but varies with the treatment of the sample, the moisture content value obtained is not the absolute or true moisture content, but only the indicated moisture content, or IMC, for the particular set of conditions under which the sample was dried.

[3]Temperatures measured with a thermocouple placed immediately beside the sample.

The principle is the same as in the methods employing reflux features, but control over the process insuring more readily repeatable results is more certain with the latter method. Another advantage of the reflux method is that a considerably smaller volume of solvent per sample is required because the solvent volume in the flask remains approximately constant. These advantages have been found to be of sufficient importance to warrant adoption of the reflux principle in most of the recent adaptations of solvent distillation for moisture determinations.

In the reflux distillation method the flask is connected to the condenser through a graduated distillation receiver. As distillation progresses, the receiver fills with extracted water covered by a middle layer of solvent-water emulsion and a top layer of clear solvent. This clear solvent overflows the receiver and runs back down into the flask where it revaporizes, bringing up additional water. The water which forms minute droplets in the emulsion of water and solvent will settle out if allowed to stand, but the quantity of water so held is not of sufficient volume to be measurable in the receivers and may be disregarded.

Water clinging to the sides of the condenser tube is flushed down at the end of the distillation period with a small quantity of dry solvent, and the apparatus is dismantled. Droplets of water on the walls of the receiver are scrubbed down with a rubber policeman and the final water volume is determined by reading the graduated receiver at the center of the meniscus between the water and solvent. The indicated moisture content in percent of dry weight of the sample is determined by subtracting this volume from the original wet weight of the sample and dividing the water volume by the difference. In order to prevent water from the solvent being deposited in the receiver and incorrectly measured with that derived from the sample, it is important that only water-free or dry solvent be used in the reflux method.

The portion of solvent which can be poured—or pressed—from the distilled samples and that from the receivers may be recovered for further use, first by reflux distilling until all the water is driven off and then by direct distilling to separate the solvent from the various extractives from the material distilled. New solvent may be dried by reflux distilling until all the water present has been accumulated in the receiver.

A 6-unit moisture determination apparatus and its solvent recovery apparatus, designed and constructed at the California Forest and Range Experiment Station, are illustrated in Figure 3. The time required for each run of six samples during routine operation, including changing flasks on the apparatus, is 65 minutes.

*Calibration of the distillation method.*—The relative magnitude of the moisture contents determined by the distillation method is dependent upon the conditions under which distillation takes place, chiefly the severity of treatment to which the sample is subjected and the length of time it is exposed to the drying process.

Different investigators have from time to time recommended the use of different solvents to meet the demands of their respective problems. Among those most frequently used are benzene, toluene, and xylene, and mixtures of these in various proportions. These solvents have different boiling temperatures and, as will be shown later, yield correspondingly different results. The practice has generally been to select the solvent which would yield results approximating in magnitude those obtained by the more familiar methods.

Xylene has been selected for use with the distillation method in fire behavior studies at the California Forest and Range Experiment Station in preference to either toluene or benzene, because it appears to give results more readily repeatable, the results are obtained more quickly, it is the least miscible with water, and it is somewhat safer to use.

The "purified" xylene used exclusively in these determinations has a normal boiling range of 137 to 140 degrees C. Several commercial grades on the market are subject to considerably more variation and may contain undesirable foreign materials. The boiling temperature of 139 degrees C. has been accepted as a standard for this solvent and all moisture determinations are computed in terms of the results obtained at this temperature. For purposes of calibration the boiling temperature may be conveniently determined by submerging the bulb of a chemical thermometer just beneath the surface of 250 ml. of boiling solvent in a 500 ml. distillation flask. Temperatures obtained at elevations considerably above sea level will be somewhat lower than the boiling range indicated.

Calibration data by which xylene results are corrected to the standard basis are given in Fig-

ure 4. The corrected volume of water is determined by substituting the appropriate value of $d$ from Figure 4 in the equation:

$$V_s = d\,W + V_a$$

where:

$V_s$ = volume of water obtained under standard conditions,

$V_a$ = actual volume of water obtained,

$W$ = indicated dry weight of sample.

The length of time allowed for distillation has been set at one hour from the time heat is first applied. This interval is the shortest which was found to yield consistent results. The volume of water removed does not attain a constant value, but increases with time due to the removal of additional amounts of bound water or to decomposition of the sample. However, the rate of loss after one hour is less than 0.1 ml. per 15 minutes, and this one-hour interval gives therefore a repeatable end point. The rate may be expected to vary somewhat with different boiling rates, moisture contents, and sizes of material distilled. Data concerning the direct distillation of wood by Bateman (*1*) indicates a longer time requirement for coarse materials. Solvents boiling at considerably lower temperatures than xylene require a correspondingly longer distillation period to reach the same state of equilibrium.

*Accuracy of the distillation method.*—The accuracy of the distillation method expressed in percent of moisture content varies with the size of the sample used and the corresponding volume of water obtained. For routine determinations of fine litter fuels, sufficient sample should be collected to yield at least 3 ml. of water, the wet weight of the sample being governed by its approximate moisture content. The use of distillation receivers graduated to 0.1 ml. permits computation of the moisture content to the nearest 0.1 percent within a consistent range of approximately 0.2 percent in the range of moisture contents commonly associated with fire weather conditions. In order to secure comparable results for green materials of high moisture content, receivers of 30 ml. capacity graduated to 0.1 ml. are employed.

Because of the tendency for both litter and green materials to gain or lose moisture during handling, all samples are collected in the extraction flasks and sealed immediately with rubber caps. Green materials should be distilled within a reasonable time after collection, and in any event, prior to the start of fermentation.

## Standardization of Results

In adapting the solvent distillation method for moisture determinations in fire behavior studies at the California Station, the decision was made to consider xylene results as standard and to convert results obtained by other methods in past fire behavior studies to this basis. The data upon which these conversions are based were derived from comparisons of pine needle litter moisture determinations by four drying processes, in three of which the severity of treatment was varied by carrying on the drying process at different temperatures.

The data summarized in Table 1 represent moisture content results obtained by each of the methods listed from a sample having an indicated moisture content of 8.6 percent by the xylene method. In most of the comparisons the moisture content of one of a pair of duplicate samples was determined by the method tested and the other by the xylene distillation method, for each variation of the method compared. In the oven-drying method, however, the average of two samples distilled with xylene was compared with the average of eight samples dried simultaneously in the oven.

Each of the methods listed has been found to yield results differing from those obtained by the xylene method by the amounts indicated in column 5 of Table 1, within a moisture content range of 0 to about 10 percent. Differences between xylene method results and those of the dry air method (*9*) may be expected to vary by approximately $\pm$ 0.1 percent, but several comparisons of xylene and vacuum oven results have shown no deviations from the tabulated differences within the moisture content range stated above. The tabulated drying-oven results are, of course, subject to the variations indicated in Figures 1 and 2.

The differences between the results by the different methods are not constants throughout the normal range of moisture contents encountered, but become progressively greater as moisture content increases because of the nature of the computations by which the indicated moisture contents are derived. For purposes of comparison it is therefore necessary to reduce all the results to a common basis. This is most readily accomplished by determining the water loss by each method in terms of loss per unit common dry weight, in this case, the dry weight obtained by the xylene method. It should be emphasized that this choice is arbitrary and does

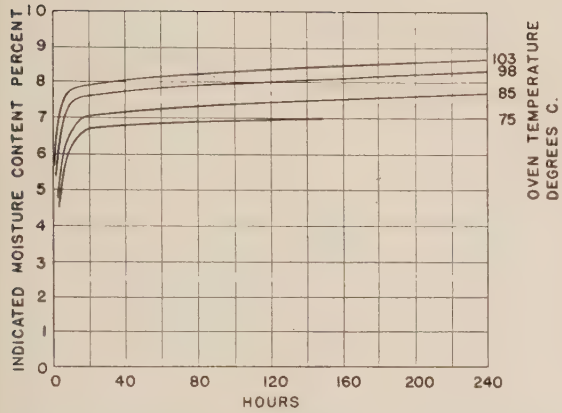


Fig. 1.—The influence of time and oven temperature upon the indicated moisture content of a typical litter sample.

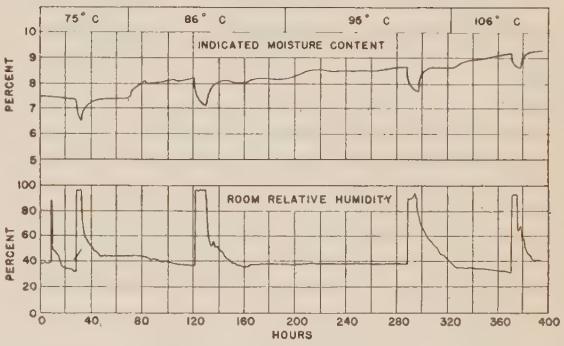


Fig. 2.—Influence of relative humidity of the room upon drying-oven results for four even temperatures.

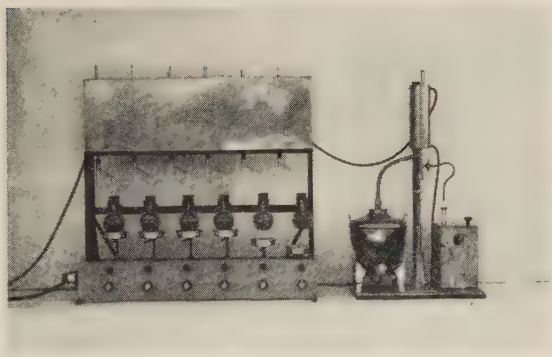

Fig. 3.—Moisture determination apparatus and xylene recovery apparatus.

The moisture determination apparatus consists of a copper condenser tank, monel-metal condenser tubes, adjustable electric heating elements, and clamps for supporting the distillation flasks, all mounted on a welded angle iron frame. The recovery apparatus consists of a 2-gallon copper retort electrically heated, reflux condenser with water trap, and a storage tank with a metered pump for supplying distillation flasks with a measured quantity of solvent.

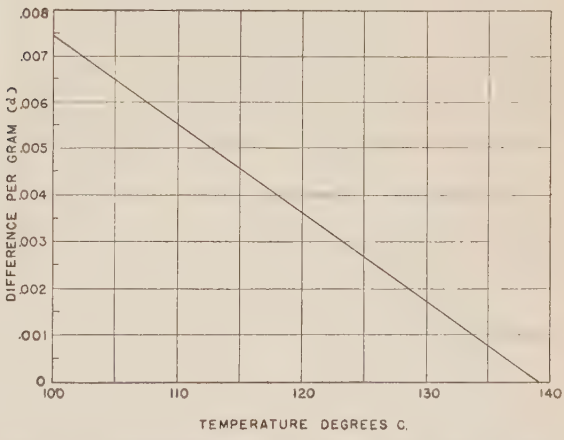


Fig. 4.—Difference in loss of water per gram of dry sample as a function of solvent boiling temperature.

TABLE 1.—COMPARATIVE INDICATED MOISTURE CONTENTS DETERMINED BY DIFFERENT DRYING METHODS AND LOSS OF WATER BY EACH METHOD IN TERMS OF XYLENE-DRY WEIGHT OF SAMPLE

| Method (1) | Temperature (2) | Time (3) | Indicated moisture content (4) | Difference from xylene determination (5) | Loss per unit weight xylene-dry sample (6) | Difference from xylene (7) |
|---|---|---|---|---|---|---|
| | *Degrees C.* | *Hours* | *Percent* | *Percent* | *Percent* | *Percent* |
| Distillation | | | | | | |
| Xylene | 139[1] | 1 | 8.6 | ---- | 8.6 | ---- |
| Toulene | 110 | 1½ | 8.0 | —0.6 | 8.0 | —0.6 |
| Benzene | 81 | 1½ | 7.3 | —1.3 | 7.4 | —1.2 |
| Drying oven | 103 | 48 | 8.1 | —0.5 | 8.1 | —0.5 |
| | 98 | 48 | 7.7 | —0.9 | 7.8 | —0.8 |
| | 85 | 48 | 7.4 | —1.2 | 7.5 | —1.1 |
| | 75 | 48 | 7.0 | —1.6 | 7.1 | —1.5 |
| Vacuum oven | | | | | | |
| (5 mm. Hg. Press.) | 100 | 24 | 8.7 | +0.1 | 8.7 | +0.1 |
| | 75 | 24 | 7.9 | —0.7 | 7.9 | —0.7 |
| | 60 | 24 | 7.2 | —1.4 | 7.3 | —1.3 |
| | 45 | 24 | 6.1 | —2.5 | 6.3 | —2.3 |
| | | (days) | | | | |
| Dry air[2] | 25 | 14 | 7.3 | —1.3 | 7.4 | —1.2 |

[1]Solvent boiling temperatures at Berkeley.
[2]With sulfuric acid (*9*).

not necessarily represent the true dry weight. It is, however, a readily repeatable and consistent value. The results obtained by the different methods are reduced to this basis in column 6 of Table 1, and the differences from the xylene value are given in column 7.

The differences in column 7 may be expected to remain constant for all moisture determinations of ponderosa pine needle litter. From them it is possible to relate moisture content values indicated by the xylene method to those obtained by the other methods listed by solving the following equation:

$$V_s = d\,W_d + L$$

where:

$V_s$ = volume of water obtained by xylene distillation

$W_d$ = dry weight of sample

$L$ = loss of weight by method used

$d$ = unit difference from xylene loss from column 7.

The slight error introduced through use of the dry weight determined by the method used instead of the xylene dry weight is not significant in computing the volume of water which would have been obtained by the xylene method from observed loss in weight by one of the other methods.

Available data for green foliage indicate larger differences for this type of fuel caused by greater differences in breakdown of the chemical structure by the various methods. Although a comparison of xylene and vacuum-oven results, Table 2, indicates larger differences, the results obtained appear to be just as consistent and repeatable as those obtained by the same methods for needle litter material.

TABLE 2.—COMPARATIVE MOISTURE CONTENT DETERMINATIONS OF GREEN LEAVES (ARCTOSTAPHYLOS SP.) BY THE XYLENE AND VACUUM-OVEN METHODS

| Treatment | Temperature | Indicated moisture content | Water loss in terms of xylene-dry weight |
|---|---|---|---|
| | *Degrees C.* | *Percent* | *Percent* |
| Xylene | 139 | 90.7 | 90.7 |
| Vacuum oven | 100 | 91.9 | 91.3 |
| Vacuum oven | 60 | 84.8 | 87.8 |

## SUMMARY AND CONCLUSIONS

For investigators in the field of forest-fire research, the xylene distillation method for determining the moisture content of forest fuels permits standardization of moisture measurements to a degree not readily attainable by other methods in common use. This is made possible by the combination of speed and accuracy, and by the limited number of controllable factors and absence of important noncontrollable factors influencing the results.

Although the well-controlled vacuum oven pro-

vides an accurate standard of comparison for moisture-content measurements, and is used extensively in other lines for this purpose, its use requires equipment not readily available to forest fire investigators. The distillation method, however, compares favorably in accuracy with the vacuum oven, possesses the added advantages of speed and simplicity, and requires only a small amount of laboratory equipment generally available.

For those working on intensive studies involving the various relationships concerned with fuel moisture content, the solvent distillation method provides a valuable means of checking the consistency of the results of their own methods, and of comparing their results with those of others in the same line of endeavor.

In addition to the foregoing uses, the method is well adapted to routine moisture determinations—confirmed by the successful operation of the method for this purpose over an extended trial period. Because of the relative speed with which determinations can be made, the distillation method is particularly suited to studies in which it is desirable to make use of the results a short time after the samples are collected.

## Literature Cited

1. Bateman, E., and others. 1929. Report of committee 8-3. Moisture content determination. Proc. Amer. Wood Preservers' Assoc. 25:180-202.
2. Bidwell, G. L. and W. F. Sterling. 1925. Preliminary notes on the direct determination of moisture. Jour. Assoc. Off. Agric. Chem. 8:3, pp. 295-301.
3. Dean, A. L. 1908. The estimation of moisture in creosoted wood. U. S. Dept. Agric. Forest Serv. Circ. 134.
4. Dean, E. W. and D. D. Stark. 1920. A convenient method for determining water in petroleum and other organic emulsions. Jour. Ind. Eng. Chem. 12:486-490.
5. Nelson, O. A. and G. A. Hulett. 1920. The moisture content of cereals. Jour. Ind. Eng. Chem. 12:1, pp. 40-44.
6. Nichols, P. F., C. D. Fisher, and W. J. Parks. 1931. Finding moisture content. West. Canner and Packer 23:11-13.
7. Walker, W. H., W. K. Lewis, and W. H. McAdams. 1927. Principles of chemical engineering. Second edition, illus. Pp. 558-559. Chem. Eng. Series, McGraw-Hill.
8. Wiegand, E. H. and D. E. Bullis. 1927. A method for testing moisture in dried prunes. Oreg. Agric. Exp. Sta. Circ. 82. Historical Note p. 4.
9. Wilson, R. E. 1921. Humidity control by means of sulfuric acid solution with critical compilations of vapor pressure data. Jour. Ind. Eng. Chem. 13:326-331.

## Soil Conservation Service Report on Survival of Plantations

THE Soil Conservation Service reports survival examinations covering about 67,000 acres of new plantations as of June 30, 1938, which show that 82 percent of the plantations established indicate a satisfactory survival at the end of the year. The average survival of these plantations is 82 percent. The 18 percent of plantations considered unsatisfactory average a fraction over 40 percent survival. Most of these will be replanted.

With few exceptions, these results were obtained by systematic sampling of the areas and by statistical analysis of the results so as to insure in general an accuracy indicated by a standard error of not more than plus or minus 5 points.

# BRIEFER ARTICLES AND NOTES

## Third International Forestry Congress

A preliminary meeting for the purpose of organizing a National Committee to make the necessary preparations for participation by the United States in the Third International Forestry Congress, Helsinki, Finland, in 1940, was held in Washington, D. C., July 6, 1939. Seventeen representatives were present from interested federal departments, agencies, and organizations.

Formation of the National Committee has been requested by the Organizing Committee of the Congress. The group that met on July 6 initiated action to that end and the following officers for a National Committee were elected: *Honorary Chairman,* F. A. Silcox, chief, U. S. Forest Service, Washington, D. C.; *Chairman,* C. L. Forsling, U. S. Forest Service, Washington, D. C.; *Vice-Chairman,* John D. Guthrie, Civilian Conservation Corps, U. S. Department of Agriculture, Washington, D. C.; *Secretary,* Henry E. Clepper, Society of American Foresters, Mills Building, Washington, D. C.

The foregoing officers were instructed to organize the National Committee which shall represent the various departments, agencies, and organizations in forestry in the United States. It is desired to have at least one member on the National Committee representing each of the following groups: U. S. Department of Agriculture, U. S. Department of Commerce, U. S. Department of the Interior, Civilian Conservation Corps, Association of State Foresters, Society of American Foresters, American Forestry Association, Charles Lathrop Pack Forestry Foundation, the forestry schools, the lumber industry, and the paper and pulp industry.

American foresters who expect to attend the Congress, particularly those who have papers to be delivered, are requested to notify the Secretary, Henry E. Clepper, promptly.

For details concerning the Congress readers are referred to the June 1939 issue of the Journal of Forestry, page 440.

## New Status for the Forestry Work of the University of California

Effective July 1, 1939, the forestry work of the University of California is advanced to departmental status. Heretofore, it has been one of 28 divisions in the Department of Agriculture. Under the new plan, there are departments of Agriculture, Forestry, and Home Economics. The Department of Agriculture is divided in turn into 26 divisions; e. g., animal husbandry, pomology. The three departments comprise the College of Agriculture, just as the departments of Civil Engineering, Mechanical Engineering, and Electrical Engineering comprise the College of Engineering. Professor Mulford is chairman of the Department of Forestry.

## National Forestry Program Under Way in Canada

Enrollment in the National Forestry Program is now under way, according to the Dominion Forest Service of the Department of Mines and Resources, Ottawa, which is charged with the administration of the Dominion's part of the program and is responsible for the approval of plans for work to be carried out by the provinces. Application forms have been supplied to provincial employment offices in the districts where Dominion work will be undertaken, and selection of youths is being made from applicants who are between the ages of eighteen and twenty-five, and who are certified by a municipal or relief authority as being unemployed and in necessitous circumstances.

Between 800 and 1,000 youths will be given training in camps under the control of the Dominion and another 3,000 will be enrolled in provincial projects.

Dominion operations will be carried out in the following forest experiment stations: Acadia in New Brunswick; Valcartier in Quebec; Petawawa in Ontario, and Kananaskis in Alberta. Camps will also be established in the following national

parks: Cape Breton Highlands in Nova Scotia; Riding Mountain in Manitoba; Prince Albert in Saskatchewan; Banff, Jasper, Elk Island and Waterton Lakes in Alberta, and Yoho and Mount Revelstoke in British Columbia.

The projects will include construction of roads, trails, telephone lines, lookout towers, fireguards, and other improvements required for forest protection and development. A number of the young men will be detailed as assistant to the rangers and park wardens. Other classes of work will include the treatment of timber stands to increase growth, improve timber quality and favour species of high commercial value by thinnings, release cuttings, and similar operations. Attention will be paid to forest recreational developments by the provision of facilities for tourist campsites, fireplaces and wells. Provision is also being made for the construction of dams and stream improvements to aid fishing conditions, and for miscellaneous projects to assist wild-life conservation.

An important feature of the program is the training which will be provided. Besides the work itself, which will give valuable experience in a great variety of woods operations, special courses of lectures will be delivered on such subjects as woods travel, forest protection, woodlands management, elementary surveying, wild life conservation, operation of mechanical transport, and construction of forest improvements.

All the provinces will participate in the National Forestry Program. Many camps opened about the first of June and by the middle of that month the work was in full sway throughout Canada.

## Markets for Forest Growth

The export angle of the problem of adequate markets for our grown and growing forest crops is attacked by a bill calculated to revive the lumber export trade that in 1938 sagged to its lowest point in forty years. This bill, S. 2546, was introduced on June 5 by Senators Holman and McNary of Oregon. A similar bill is under consideration by members of the House Committee on Merchant Marine.

Foresters will remember the lumber export resolution of the National Forest Conservation Conference in April 1937, as follows:

> In recognizing lumber as an export product, the trade agreement and tariff agencies of the government are making findings and taking action that affect the welfare of our forests. They should seek to increase the export outlets for forest products as a means of encouraging better forest practice by commercial forest landowners, and should encourage action toward these objectives on the part of other agencies of the federal government.

At that time in 1937 the new Maritime Commission was just in process of complete organization; that brought the Merchant Marine Act, 1936, into effect. The Holman-McNary bill proposes to provide competitive shipping rates and adequate shipping services to lumber and manufactured timber products exported from the United States by putting into practice the policy of shipping aid to export of lumber and farm produce, cotton, coal, and cement defined by Congress in Section 211(h) of the Merchant Marine Act of 1936; through subsidies to shipping operators to provide, or the Commission to prescribe, export rates as low as those of principal foreign competitors to the same common or comparably distant markets abroad; or for the same purpose to lease vessels and allocate space, or to operate vessels. The advantage of foreign competitors in the export lumber trade, in shipping alone, from subsidized rates or subsidized cargo or both, usually ranges between $1 and $2 per thousand feet.

From another government program—trade agreements—lumber continues to hope for relief from foreign import discriminations against American lumber. The principal discriminations are the British levy, 10 percent C. I. F. on most American lumber, but no levy on Empire lumber, and the Australian-New Zealand additional duty on American lumber of one pound or $3.75 at present per thousand feet. The effect of these discriminations and shipping subsidies on our lumber exports is shown by the facts that American export of lumber rose from 1,004,000,000 board feet in 1899 to over 3,000,000,000 board feet in 1928-29, and then, following the wave of foreign preferential tariffs, foreign import discriminations and subsidies, and with the Oriental situation, the exports dropped to 947,453,000 board feet last year, the lowest point in forty years.

Foresters will be especially interested in the results of European overcutting, except in interior Russia with only bottle-neck railroads for little export, reflected in following National Lumber Manufacturers Association notes: In 1928 the nearly world total export of softwood sawn goods by Europe and North America found the

American share 20 percent. By 1937 the American portion had dropped to 9 percent, although European export in that year was less by nearly one-sixth than 1928. Last year even the greatly decreased supplies of European soft sawtimber in export areas, which brought European export down more than one-third below 1928, failed to aid the United States, our share in exports of the sawn softwoods from Europe and North America being but 8 percent.

The Holman-McNary bill is a practical step toward securing for the export, in manufactured form, of the surplus American forest growth, shipping services and shipping rates no less favorable than those available to our principal foreign competitors. The bill should have widespread forestry support.

J. C. Nellis,
*National Lumber Manufacturers Association.*

### Sliding Drawer for Instrument Shelters

Many weather stations are in need of a convenient and visible storage space for wind velocity tables, psychrometric tables that are used in securing relative humidity from wet and dry bulb readings, rain gauge stick, ink, and other supplies.

At Wind River Experimental Forest this problem has been solved by placing the tables under glass, in a sliding drawer, which is mounted under the standard louvered shelter. Inside dimensions of the drawer are 3 by 12 by 24 inches. This size allows length for a 24-inch (2.00 rainfall) rain gauge stick, and width enough for placing the tables in the front of the drawer where they are more accessible for reading. The depth is convenient in that hygrothermograph ink, anemometer oil, and other supplies essential to the operation of the station may be stored behind a cleat in the back of the same receptacle. Use of the cleat prevents anything from covering the tables.

In order that the fuel stick (in R-6 type fire danger stations) will have room to swing freely from the scales, the drawer is hung in a frame against the right side of the supporting legs. Protection from the weather is secured by covering the right and back sides of the shelter support for six inches down from the floor of the shelter proper. Further protection is afforded through the addition of a six-inch writing shelf just below the hinged door that will project out over the drawer. The details of the sliding drawer are shown in Figure 1.

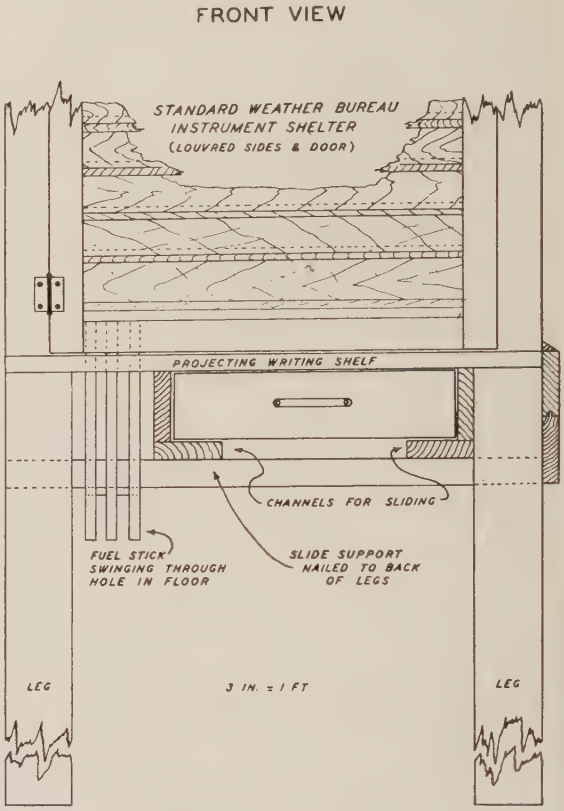


Fig. 1.—Construction details of a sliding drawer for instrument shelters.

The cost of this device is nominal in that it can be made from scrap lumber in two hours' time. Scrap plywood is suitable for the sides and bottom of the drawer. In construction, the back support for the sliding channels is made in the same manner as the front support, and shelter is added to the back legs just as that is on the side shown in end view of the illustration. Shelter is not needed on the left side. Installation of a 1 by 1 inch center rider and grooving the back end of the drawer to fit will forestall any tendency to stick.

Loyd Bransford,
*Pacific Northwest Forest and Range Experiment Station.*

### Plant Succession on Denuded Soil in Western North Dakota

During the decade 1920-1930 much land in western North Dakota was broken up and seeded

to wheat and flax. The virgin soil, ample rain, and good prices combined to start a farming boom on land that was obviously unsuited to cultivation. Immediately following 1930 the boom began to collapse; the humus in the soil was depleted, the prices of wheat and flax fell, an unprecedented drought began, and grain fields were plagued with grasshoppers. Many farmers were bankrupt; others continued operations only with the aid of the government through A.A.A. soil conservation program. The result was many thousands of acres of denuded land producing nothing of value, but offering an extensive opportunity for the study of plant succession.

Various attempts, particularly on the Fort Berthold Indian Reservation, were made to revegetate this abandoned farm land by reseeding. In the spring of 1936, several thousand pounds of western wheat grass seed (*Agropyron Smithii*) were planted, but no beneficial results were obtained. In 1937, 100 pounds of crested wheat grass seed (*Agropyron cristatum*) were planted on an abandoned field. The seed was scattered broadcast by hand before the frost was out of the ground. No attempt was made to secure a complete stand; the seed was scattered in narrow strips in the hope that seed from the original plants would eventually fill the unseeded areas. A fair stand was obtained, and a crop of seed was produced in 1938, the results from which are not yet evident. In the spring of 1938, 25 pounds of blue grama grass seed (*Bouteloua gracilis*) were scattered on the back slopes of several dams built by the C.C.C. This seed was planted early in the spring (March and April) and covered lightly with a garden rake. Final results are not yet available, but it is evident that a much better stand was obtained where the surface of the dam was covered with top-soil, than where sterile subsoil formed the surface of the dam.

The results of these experiments show that reseeding abandoned farm land is an expensive and hazardous undertaking. Seeding efforts should be confined to fields completely devoid of good forage species, and then limited to narrow strips. If the seeding is successful, with proper management, the natural spread of the planted grass will eventually cover the entire area.

It is unfortunate that no exact records are available of the composition of the former vegetation on any particular tract, and of the exact length of time required for each specied of native vegetation to re-establish itself. However, personal observations since 1935 and oral descriptions by residents of the region establish certain rather definite conclusions. Abandoned fields are invariably covered with a dense stand of Russian thistles (*Salsola pestifer*) until replaced by the more permanent perennial species. Other annual weeds, chiefly lamb's quarters (*Chenopodium album*), pigeon grass (*Setaria viridis*), panic grass (*Panicum capillare*), and sometimes wild sun-flower (*Helianthus annus*), soon appear and form a fairly good ground cover, and sometimes furnish a poor grade of hay.

The length of time required for the appearance of the more desirable perennial grasses, to replace the weedy annuals, is dependent upon the length of time the land was under cultivation. Land broken up and farmed for only one or two years is soon covered with a good stand of western wheat grass, obviously from the roots of the grass that had not been killed by cultivation. Needle grasses (*Stipa comata* and *S. viridula*) are frequently found after a few years. No case has been observed where blue grama grass has re-established itself on abandoned farm land; although nearly every piece of land broken up must have previously supported some grama grass. Where perennial plants were completely killed by thorough cultivation, no cases have been observed of stands of perennial forage grasses of any species becoming re-established. Fringed sagebrush (*Artemisia frigida*), although not a desirable forage species, is one of the first perennials to become established. A great many other species occur, sometimes in great abundance, but so scattered and irregularly that their appearance seems to be determined by local seed supply. In no case has an abandoned field progressed far enough to approach climax conditions.

Good range management, with deferred grazing during the growing season, appears to be essential in re-establishing productive range conditions on abandoned farm land. Reseeding projects are hazardous undertakings, but where the perennial grasses have been completely killed by thorough cultivation, it may be necessary to seed the land in strips to provide a source of desirable species to revegetate the area; otherwise the site will be taken by undesirable weed plants.

Crested wheat grass, and, where viable seed of these native plants is available, western wheat

grass and blue grama grass, are considered the best species for reseeding in this region.

If, in building dams, roads, or other improvements where a considerable expanse of denuded soil is necessarily left exposed, frequently on very steep gradients, the engineer in charge will cover the surface with a thin layer of top-soil, the length of time required to establish the plant cover necessary to prevent excessive erosion will be greatly reduced.

V. T. Heidenreich,
*Fort Berthold Indian Reservation.*

## Additional Notes on Marking Trees with Spring Spray Guns

Following publication of the brief article on spray guns by Folsom,[1] J. A. Cope and the author decided to try a spring spray gun for use in woodlot improvement demonstrations. We found the gun was handy and clean to carry and use, and saved a great deal of time in marking the circumference of demonstration plots and also for marking crop trees in white pine stands and in sugar bushes. Experiments have just been completed with a smaller gun.

We first used a different model than the Alemite gun described by Folsom. We tried the "Balcrank" Type HWA, which upon recommendation of C. R. Farrington, then project chief of Tioga County, N. Y., Timber Survey, was remodeled by removal of the wire screen at the base of the pump. Instead of lead paint, which seemed to clog the nozzle we mixed kerosene with a yellow implement paint having a zinc oxide base. The nozzle clogs unless the gun is thoroughly cleaned after each day's use, which is a messy job, unattractive to lazy or busy people. In the carrying box we found it necessary to include a pair of pliers and a small piece of fine wire with which to clean out the nozzle. These implements, in addition to the leather punch on a Scout knife, served to put the gun back into operation. This gun had sufficient capacity to mark the limits of five or more quarter-acre plots. For one or two plots, there was more work involved in cleaning the gun than was saved from the old pail-and-brush method.

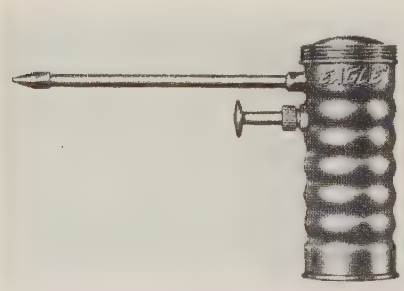


Fig. 1.—General view of the No. 66 "Handy oiler."

This fall we tried a handy oil can (see Fig. 1) manufactured by the Eagle Manufacturing Company, Wellsburg, W. Va. This gun costs only $1. Its capacity is limited to a half-pint (enough to delineate the quarter-acre plot); it carries up to ten feet; can be easily carried in a brief case; and can be filled handily from flasks containing the 50-50 mixture of paint and kerosene. It will use heavier mixtures such as 60-40 or even 75-25 paint and kerosene which are more durable and noticeable on the trees. It is also much lighter in weight than the Alemite or Balcrank models, and does not clog after standing idle for several days.

Folsom's cost of $1.53 per gallon for 50-50 mixture is not statistically correct, accepting his estimate of $1.40 per gallon for paint and 13 cents per gallon for kerosene; $1.40 plus 0.13 is $1.53 for *two* gallons or $0.765 per gallon. Thus 19 cents per quart seems more like the average cost.

James D. Pond,
*Cornell University.*

## Notes on the Upper Fraser River Valley Spruce of British Columbia

It had always been supposed that the prevailing spruce species in the northern interior region of British Columbia, along the upper reaches of the mighty Fraser River, (the so-called "Cariboo Region"), was Engelmann spruce. However, recent reconnaissance studies conducted by F. S. McKinnon, of the British Columbia Forest Service, and B. G. Griffith, of the University of British Columbia, in which the writer was privileged to participate, have definitely determined that the prevailing species of spruce, along the Prince Rupert Division of the Canadian National Railway, between Prince George and McBride, B. C., (that is along latitude 54° North between

[1]Folsom, J. B. A practical tree-marking instrument Jour. Forestry 35:305-307. 1937.

Table 1.—Relation between the Age and Diameter of White Spruce in the Cariboo Region of British Columbia

| D.b.h. | Age on stump |
|---|---|
| *inches* | *years* |
| 10 | 102 |
| 11 | 107 |
| 12 | 111 |
| 13 | 116 |
| 14 | 120 |
| 15 | 124 |
| 16 | 128 |
| 17 | 132 |
| 18 | 135 |
| 19 | 138 |
| 20 | 142 |
| 21 | 145 |
| 22 | 148 |
| 23 | 151 |
| 24 | 153 |
| 25 | 156 |
| 26 | 158 |
| 27 | 161 |
| 28 | 163 |
| 29 | 165 |
| 30 | 168 |
| 31 | 170 |
| 32 | 172 |

longitude 120° and 123° West), is *not* Engelmann but white spruce, *Picea glauca*.

Under a recent revision of the United States' tariff law "western white spruce" lumber is admitted duty free, whereas Engelmann spruce pays $1.50 per thousand feet on the lumber. Obviously, it was of vital importance to the sawmills located along this division of the Canadian National Railway in British Columbia, to ascertain which species of spruce—White or Engelmann—they were cutting and in what proportion.

The wood of these two species is indistinguishable—so are the bark, foliage, and general appearance. Only in the cones is there a reliable means of identification. The cone-scales of white spruce are broader than they are long and usually entire at the margin. Those of Engelmann spruce are narrower than they are broad and usually erose at the margin. However, variations occur in the cone scales of both species making positive identification difficult.

Where logging was in progress the actual source of cones was easily determined; that is, the cones adhering to the crown of the trees felled could be examined and related to the recently cut trunk *before* the logs were skidded. Where logging was not in progress, the cones at the base of the trees were the only means of identification. Squirrels hoard these cones and carry them about, so that this method is subject to obvious criticism, nevertheless, the fact remains, that the majority of cones found were *in situ* and were undoubtedly those of white spruce.

Of the 402 trees thus examined, only 3 were found to be Engelmann spruce. The diameter b.h. (measured with a tape) ranged from 9 to 38 inches. The preponderant sizes are from 16 to 22 inches.

Incidental to the work of identification, 28 stump counts of undoubted white spruce were made and the age in years on stump related to the d.b.h. before the butt log was skidded. The results, after plotting and harmonizing, are shown in Table 1.

The stands examined, while mature, differ from those in the vicinity of Aleza Lake where the spruce is overmature and ages of 250 years or more are common.

It would appear that, allowing 8 years to reach the average stump height of 30 inches, a size of 20 inches d.b.h. is reached in 150 years. This is the preponderant size of the spruces examined (38 of the 402) and corresponds to the technical rotation for sawlog production.

In a recent article Barnes[1] has pointed out that in these stands the original proportion of 80 percent spruce and 20 percent balsam fir (*Abies lasciocarpa*) is reversed by logging (since only the spruce is cut) *but* in the long run the proportion of spruce to balsam is reestablished, always provided that fire is excluded.

Further light on the stands in question will be shed by the studies now under way at the Aleza Lake Experiment Station of the B. C. Forest Service.

A. B. Recknagel,
*Cornell University.*

## More on Simplified Permanent Sample Plots

The permanent sample plot technique described by Stott and Ryan (Jour. Forestry 37: 347-349) bears somewhat the same relation to that used by the writer that the ordinary line-plot cruise does to the continuous strip. The circular plot method has many advantages, and is well adapted to a small crew of one or two men, as pointed out by the authors. With reasonable uniformity of stand over large areas it gives an

[1]Barnes, G. H. The development of uneven-aged stands of englemann spruce and probable development of residual stands after logging. Forestry Chron. 13:417-457. 1937.

accurate sample. Resort was made to the continuous belt or strip because so frequently plots fell on the borders of stands, at type changes, and in spots unrepresentative of the forest as a whole. It is of course quite possible to map the location of trees on a 16.5-foot strip and dispense with numbering as is done on the circular plots. Presumably the mapping would be even simpler and more rapid than on circular plots. The center post required for each circular plot is a modest requirement to be sure, and if it can be cut on the spot no great objection can be raised in point of economy of time and effort, but this is not always the case. Three specific experiences with the permanent line-plot method may be cited:

1. Two series of 40-acre blocks in northern New Hampshire where hardwoods were girdled on one-half of each block were laid out with permanent plots at 20-rod intervals along strips. After 10 years it was difficult to locate some of the plots since stakes had been knocked over or obscured by weeds, and the strip line had not been marked throughout, but only the ends.

2. The Jericho Experimental Forest of approximately 10,000 acres in the same region was cruised in 1926 by the line-plot system, and the center of each plot permanently marked. The two trees nearest the center were measured in detail and borings taken. With recurring logging operations it has proven practically impossible to relocate these plots.

3. The Fox Forest in Southern New Hampshire was cruised in 1935 by the line plot system. Creosoted pine stakes, painted white and bearing metal numbers, were set at all plot centers. The cruise lines between stakes were marked by one-inch paint dots at breast height on opposite sides of the trees with a bright yellow lacquer (the "traffic lacquer" used by the highway department in painting center lines on paved roads). Again the two trees nearest the center were tagged and measured. Considerable labor and expense were involved in packing in and setting the stakes. Many have been broken in logging operations, and, after the destruction of the forest by the recent hurricane of September 1938, about 400 out of 550 stakes have been broken down and buried under slash. However, the painted cruise lines are still traceable, and were utilized during the past winter in assigning strips for cutting crews. They have been fully justified.

Another instance which may be mentioned is the Bolton Mountain Forest of about 5,000 acres in northern Vermont. The centers of the cruise plots were permanently marked many years ago, but have not been rechecked to the writer's knowledge.

These misadventures occurred, to be sure, through no defect of the line-plot system itself, but from faulty subsequent work in following up the original cruise or inadequate marking of the location. It seems logical to conclude that:

1. The most important thing about a permanent sample plot is that it be possible to find it for re-measurement. When refinements of numbering are dispensed with it becomes all the more necessary that the center stake or corners be easily relocated. Experience has shown that a plainly marked cruise line is easily picked up, and is useful in orienting other work.

2. Both continuous belts and circular plots at intervals are satisfactory, and each have advantages peculiar to the special stand and type or purpose of the investigation.

3. Mapping the location of trees instead of numbering them places even greater reliance on the permanence of some datum point. There is a distinct advantage in marking the exact place of measurement on the tree.

This discussion serves further to emphasize the necessity for painstaking in the details of laying out work in the woods. Man-made marks often disappear in a surprisingly short time. Even difference in the season may make relocation difficult; stakes may be covered by snow when visited in winter; stakes set in winter may fall down. Perhaps we will soon come to marking forestry work with stone monuments as has been customary in some countries.

HENRY I. BALDWIN,
*New Hampshire Forestry and Recreation Department.*

## VISUAL AIDS IN TEACHING FORESTRY—DON'T OVERLOOK STILL PICTURES

Still pictures are coming back into more general use as a visual aid in education and extension. This is because they make a direct appeal and are effective. They comprise pictures on glass slides and on film strips.

The film strip (35 mm. in width) is now wide-

ly used, as is the standard size (3¼ by 4-inch) glass lantern slide, but the 2 by 2-inch glass slide showing colored or uncolored pictures by means of a special film-strip projector attachment is relatively new. The convenient size and low cost are attractive features, but these diminutive slides cannot be colored by hand. Pictures if in color must be colored picture films.

The supreme picture now-a-days consists of a Kodachrome or other photograph film in colors, 35 mm. in width, mounted between two glass slides (2 by 2-inches) and shown by means of using a special film-slide projector. Such a projector, together with a supply of both black-and-white and colorchrome slides, for variety and punch in lifelikeness, make up a very usable and satisfactory kit for talks or lectures before small or moderately-sized groups. For best results before large audiences, still pictures on the standard size lantern slides and preferably hand-colored are most impressive.

### STILLS AND MOTION PICTURES

Motion pictures must have at least the quality of being entertaining. But, real teaching that leads to action is most effectively accomplished by means of adding some still pictures as a feature. This conviction is based upon my observation and experience over a period of years with rural and town audiences.

As a diversion in the motion picture program, people are quite ready to relax and will generally give close attention to the showing of still pictures. Their striking contrast to motion pictures makes them impressive. Then there is the additional feature of the voice of the lecturer or speaker "in person." A good way is to show the stills in the most impressive part of the program which psychologically is the last part.

In the meeting, the announcement of the film strip or slide feature might be made in some such fashion as: "We have a few specially selected still pictures to show you. These will interest you no doubt as some (or all) are local views taken in the state (or county). I am sure you will want to see each photograph and hear all about it. The views have been carefully selected to show" (in the case of farm audiences) "what you can do to make your farms more profitable by means of caring for your trees and woodlands."

In showing the stills, the speaker talks concisely, directly, friendly, and enthusiastically about each picture, whether it be on protection, cutting and stand improvement, planting, recreation, or wildlife. Perhaps 15 to 25 views represent a good number to be shown before an average audience. If well conveyed, this personal message will be the information and inspiration that the audience will carry home and put into practice.

### KINDS OF EQUIPMENT

Various states are equipping their workers with slide and film strip outfits, some to the extent of nearly every county. Such equipment is admirably well adapted to teaching profitable forest management.

A recent report showed that the state specialists who are equipped with colored slides or films are the ones most often invited by the farmers to visit the county.

The various units of equipment that are being most generally used as visual aids include:

Standard size lantern slide projector.

Film strip projector with 2 by 2-inch slide attachment.

35 mm. camera for taking colored photographs.

16 mm. motion picture projector.

16 mm. motion picture camera.

WILBUR R. MATTOON,
*U. S. Forest Service.*

## WHAT PRICE THINNING AND WHAT VALUE

Between January 1, 1933 and December 31, 1938, 237,188 acres of young ponderosa pine growth have been thinned on the Harney and Black Hills National Forests in South Dakota and eastern Wyoming. About 90 percent of this work has been done by C.C.C. crews and has required about 4 man-days per acre.

One could soar high in the realm of pure mathematics (and statistics), and probably never come to earth again, in an effort to arrive at the cost per tree and per thousand board feet. It would be too bad, however, for the author to spoil the reader's chance for amusing himself along this line by committing any ideas to writing. One could soar still higher into the realm of social speculation, and offset costs with the moral and social advantages of wholesome outdoor work to boys of C.C.C. age, but there again the reader perhaps should have complete freedom.

Since such soaring is likely to be influenced by a knowledge of the results obtained, however, a few observations on the effects of these thinnings might be worth-while.

In September 1938, a telephone right of way on the Harney National Forest was cleared through a stand of ponderosa pine saplings that had been thinned shortly before the end of the growing season in 1934. Forest officers working on the telephone project were interested in observing the growth rings on the trees cut, and their curiosity was well rewarded. What they found is represented by the cross section submitted by Supervisor Snow.

This cross section tells its own story, which, according to eye-witnesses, is about average for the trees cut on the right of way. It shows 49 annual rings, a total diameter of 3⅛ inches, and a cross-section area of .053 of a square foot. Forty-five annual layers were accumulated before thinning and at that time the cross-section had an average diameter of 2.34 inches and a cross-section area of .03 of a square foot. Therefore, the growth during the past four years has amounted to over .78 of an inch in diameter and .023 of a square foot in cross-section area; or in other words, the diameter growth during the last four years has amounted to 33.5 percent of the diameter growth during the preceding 45 years, and the volume growth, as indicated by basal-area measurements, has amounted to 77 percent of the volume growth during the 45 years preceding thinning.

Another comparison indicates that the volume growth during four years since thinning is equal to the volume growth during 32 years preceding thinning. Before thinning the average annual increase in diameter was .05 of an inch per annum, and since thinning it has amounted to .2 of an inch. Thus the diameter growth has been increased 400 percent by thinning, and the volume growth has been increased 800 percent. Applying this to the stand, in which it is assumed that increased growth will not be effective for more than 30 years, we may assume that the average rate of diameter growth over a period of 30 years will be .1 of an inch per annum. Let us assume, for the sake of a little silvicultural "soaring" that through successive thinnings, perhaps for posts, poles, or other useful products that will pay for the thinnings, such a growth rate could be maintained for 110 years.

At this rate, 14-inch trees at the age of 160 years would not seem to be out of reason. At the rate which prevailed before thinning (i.e., .05 of an inch per annum) the particular tree in question would have a diameter of 7.8 inches at the end of 160 years, and would require 280 years to reach a diameter of 14 inches, if it could live so long under the conditions which would probably exist. Thinning, on this basis, would reduce the rotation by 120 years, or 43 percent. If 100 14-inch trees per acre could be carried to an age of 160 years with an average volume of 150 board feet per tree, the result would be a stand of 15,000 feet per acre, whereas if 200 unthinned trees with an average diameter of 8 inches remained for 160 years they would produce a theoretical volume, at 20 board feet per tree, of 4,000 board feet per acre. Time, however, is not the only consideration. Even if this stand of unthinned trees—or at least 750 of them—could all be carried for 280 years with a gross volume of 15,000 board feet per acre, it is probable that defect would reduce the net volume by 30 percent or more.

These are flights of fancy, but the major premises are conservative enough to give them some substance. Furthermore, it is not an academic question applying to a few test plots, but is a matter of practical wood production applied to a total area of nearly 250,000 acres, and an area which is being increased at the rate of several thousands of acres annually.

H. D. Cochran,
*U. S. Forest Service.*

## Poster Stamps to Aid Fire Prevention Campaign

A million poster stamps, reproductions of the new forest fire prevention painting by the celebrated artist James Montgomery Flagg, are being issued by the American Forestry Association in a nationwide campaign this summer against man-caused forest fires. The stamps, in four colors, are designed for use on letters, envelopes and other mailing pieces, and are available in sheets of 100 stamps.

The stamps are available at $1 a sheet of 100 stamps, and may be obtained by writing the American Forestry Association, 919 17th Street, N. W., Washington, D. C.

# REVIEWS

**Conservation in the United States.** By A. F. Gustafson, H. Ries, C. H. Guise, and W. J. Hamilton, Jr. *xi+445 pp. Illus. Comstock Publishing Co., Inc., Ithaca, N. Y. 1939. $3.*

Since Ely and his associates in 1923 assembled a group of essays under the title *The Foundations of National Prosperity*, the symposium habit among authors of conservation literature has persisted. The product is less confusing when the authors are so located that they can confer readily and achieve some unity in presenting the several contributions. Exactly this appears to have happened in the writing of *Conservation in the United States*, the work of a soil scientist, a forester, a zoologist, and a geologist.

Intended to be a nontechnical presentation of the important facts concerning the conservation of natural resources, the volume avoids, almost religiously, any discussion of the political and economic hurdles to be cleared in our conservation program. While this may be a grievous omission from the viewpoint of the undergraduate and the lay-reader who really do need the services of the interpreter, the work as a whole is up-to-date, accurate, and contains a number of new features. The teacher will find it useful, for example, in furnishing the background knowledge of natural history and of the ways in which natural resources are depleted. The excellent chapter on the western grazing lands, the emphasis of economic values and nongame species in the chapters on wildlife, and the very comprehensive treatment of soils and mineral resources, supply, under one cover, that which many a weary hour of reference exploring could not compass.

Besides an introduction in which the history of the conservation movement is recounted, the text is divided into four parts. Part 1 includes soil and water resources and affords a happy opportunity of pointing out the interlocking nature of conservation problems and remedies. The reader is not allowed to forget that ice, wind, rainfall, waves, farmers, and consumers must be dealt with in maintaining soil depth, reservoir volume, and serviceable streams.

Part 2 discusses forests, parks, and grazing lands, giving the reader a thorough picture of forest depletion and of public forestry, but according scant and discouraging treatment to industrial forestry, a type of enterprise which so far has had little sympathetic help from the public. No mention is made of the N. R. A. adventure in self-regulation by the lumber industry. National parks and monuments and state parks are described, and while generous credit is given to the National Park System as an educational force in promoting conservation, the dangers of unwarranted expansion under political pressure, and of commercial exploitation of the real national parks, are mentioned. The chapter on western forage resources is the most thorough one yet seen by this reviewer in any conservation textbook.

Part 3 indicates the zoologist's approach to the conservation of wildlife, rather than that of the game manager, but it accords a refreshing rest from the tendency to consider wildlife as game animals only. One may differ with the author of this part of the book in his belief that the hobby of attracting and feeding birds about one's home constitutes an important practice of conservation. On the other hand, no fair-minded reader will be disappointed that the much persecuted "predators" are given their day in court, and that insectivorous birds, toads, alligators, skunks, whales, and pelicans are considered natural resources.

Part 4, in which mineral resources, with their peculiar difficulties of maintenance, are reviewed, is presented so that one who has never even had a course in geology may read it intelligently. Maps, diagrams, and half-tones, plentiful throughout the whole book, are unusually illuminating in this section, and the discussion of non-metallic minerals has not been neglected. The significance of world trade is implied in the statement that the mineral supplies in the world as a whole are so great that we need not fear the early exhaustion of any mineral.

Questions for the student at the end of each chapter are thoughtfully phrased. Indeed the answers are not always to be found in the text, and he who can phrase a question that will make his students think is rendering real service in any field of knowledge. A list of references for supplementary reading is included.

Teachers and students of conservation will want this newest book in their classrooms and libraries, and the vast number of thoughtful laymen who seek ways in which they may contribute to better conservation, will find it readable, interesting, and accurate.

SHIRLEY W. ALLEN,
*University of Michigan.*

**Plant Competition in Forest Stands.** By Clarence F. Korstian and Theodore S. Coile. *125 pp. Illus. Duke University School of Forestry Bull. 3. Durham, N. C. 1938. $1.*

This bulletin reports the results of a series of trenching experiments in the Duke Forest. In 1932 sets of two plots of one mileacre each were established in a 31-year-old loblolly pine stand and in a 42-year-old shortleaf pine stand. In 1933 plots were established in five additional stands: loblolly pine 9 years old, post oak-blackjack oak 31 years old, uneven-aged white oak-black oak-red oak, loblolly pine 31 years old, and red gum-yellow poplar. Several soil types were represented. One plot in each set was trenched and charts showing the distribution of tree roots in the various soil horizons were prepared.

After trenching, both the treated and the control plots were divided into 100 squares and the vegetation was charted. Stem and crown maps were prepared for each set of plots. Observations were made on the vegetation each year through 1936. Soil moisture was determined toward the end of dry periods during the growing seasons from 1933 through 1936 on all trenched and control plots. Light intensity on the plots was measured with a Western illuminometer. In 1936 the surface soil in six sets of plots was analyzed for organic carbon, total nitrogen, nitrates, and ammonia.

With few exceptions the soil of the trenched plots contained significantly more moisture than the corresponding control plots. It is stated that, "In most instances when soil moisture conditions in the control plots were critical, following long periods of dry weather in the middle or latter part of the growing season, the trenched plots contained ample soil moisture for the use of the vegetation." The criterion used to determine when soil moisture was "critical" evidently was not the point at which the moisture fell below the wilting percentage. Only once in one of the control plots did the moisture content in the A horizon fall below the wilting percentage. Light intensity was similar on the paired trenched and control plots. Analysis of variance of the four chemical features measured indicated no significant difference between the paired trenched and control plots.

"Marked changes occurred in the vegetation of the trenched plots after trenching; changes from the initial cover, the changes with respect to the vegetation of the control plots. In general, the vegetation of the trenched plots became more mesic in response to improved moisture conditions as compared to their original condition and as compared to the paired control plots. Trenching was followed by increases in number of individuals, number of species, and general luxuriance of vegetation. During the last two years of the study competition among the individuals within the plots tended to cause a reduction in the number of individuals. Plants recognized as being xeric in character were in many cases reduced in number in the trenched plots as more vigorous mesic plants expressed dominance."

"The establishment and growth of tree reproduction was far better on most of the trenched plots than on their paired control plots."

The work under review substantiates the principal conclusions reached by other investigators. It is evident that available soil moisture is extremely important for the development of vegetation under forest canopies; deficient moisture supply frequently becomes a limiting factor. However, it is to be hoped that recognition of the importance of soil moisture will not lead to neglect of light and other factors. It may be pointed out that vegetation on trenched plots 5 and 7 did not show much response to treatment in spite of the fact that soil moisture was increased significantly. Light intensity on these plots was lower than on any of the others.

A few typographical errors occur. Further, reference is made to Romell (1938) in the section "Literature Cited" but no citation appears in the text; Korstian (1936) is cited in the text but the reference does not appear in the literature cited.

The writers are to be complimented on having produced a well-written, well-illustrated report. Without doubt this is the best designed and most extensive investigation of the influence of trenching that has been carried out in America.

H. J. Lutz,
*Yale School of Forestry.*

**Economic Status of College Alumni.** By Walter J. Greenleaf. *Office of Education, U. S. Dept. Interior. Bull. 1937, No. 10. 207 pp. Government Printing Office, Washington, D. C. 1939. 25 cents.*

Thirty-one universities cooperated in this study of how graduates fare after they leave college. It is based on the replies of more than 46,000 alumni who were graduated with bachelors' degrees in 1928 to 1935 inclusive.

Some intensely interesting general conclusions are revealed. For example, "the most advantageous way for a graduate to find work after college is through an active personal solicitation of his own without waiting for anybody to find a job for him." About one-third of the first jobs after college are obtained by personal search of the graduates.

Experience prior to graduation is the next most important asset in locating the first job. In fact, experience plus personal initiative account for 55 percent of the placement of graduates in first jobs.

It is also interesting to observe that 42 percent of the men in this study had been idle one or more months since graduation. The typical period of unemployment following graduation varied from three to nine months.

As regards forestry graduates, the study throws a brilliant light on several matters about which the profession previously had been in darkness. Without wishing to detract, even by implication, from the value of the study, the present reviewer, however, feels constrained to point out one of its shortcomings. Although 31 institutions cooperated in the project, only one was a university with an approved school of forestry, the New York State College of Forestry, at Syracuse. The author points out that the study is unique because uniform questionnaires and procedures were used by 31 cooperating institutions, and calls attention to the fact that studies made in this field usually concern graduates of single institutions. Nevertheless, for forestry the study cannot claim to be representative of universities for the country as a whole since only one approved forestry school is included.

On the other hand, the number of forestry graduates of the eight classes 1928-35 inclusive who answered the questionnaire was 244. Guise[1] has shown that 2,990 undergraduate degrees in forestry were granted during this period. Hence the returns from the forestry alumni represent a 9 percent sampling, whereas returns for the alumni study as a whole represent a 5 percent sampling. In short, the forestry sampling is higher than the average for all the 40 courses sampled. It is fortunate therefore that, since only one approved forestry school was included in the study, it was the New York State College of Forestry, which has the largest enrollment of undergraduate forestry students in the country.

Another enlightening feature of the study is "Occupational Salaries." Foresters will be interested to know that "Among the best paid positions for college men immediately after graduation are dentistry, forestry, and telephone work, which pay typically $2,000 or more." Eight years after graduation the groups who earned typical salaries of $2,500 or more were "in dentistry, medicine, law, public office, architecture, insurance, research, forestry, business, and telephone work."

In the chapter "Occupations of Alumni, 1936" the author uses a classification system which as regards forestry appears to be arbitrary and somewhat loosely arranged. For example, forestry is listed under "general occupations" and not under "professional," where it unquestionably belongs. Athletics, however, is given professional status; as an occupation athletics is certainly less professional in character than forestry. Incidentally, 0.8 percent only of the alumni of 30 universities of 1928-35 inclusive were reported as being in forestry. The two professional groups with the highest occupational percentages were teaching (17 percent) and engineering (13.2 percent).

As an official report of a project in educational research, this bulletin provides much useful information on what might be called the financial worth of a college education. It should be especially valuable to forestry educators.

Henry E. Clepper.

[1]Guise, C. H. Statistics from schools of forestry for 1938: degrees granted and enrollments. Jour. Forestry 37: 197-202. 1939.

**The World of Plant Life.** By Clarence J. Hylander. *xxii +724 pp. Illus. The Macmillan Company, New York. 1939. $7.50.*

There undoubtedly are large numbers of people who are interested, in more than a casual way, in the world of plant life with which they find themselves associated. For obvious reasons the intensely scientific treatises of botany are insufficient to satisfy the particular intellectual cravings of these groups for a fuller knowledge of plants. Students in elementary courses, for example, who have no intention of taking more than a minor interest in botany, are prone to leave their formal classes with a feeling of disillusionment over the material that has been presented, not being able to appreciate fully the breadth of the field to be covered in a limited time. Toward these students, and toward all others who profess a desire for a better general knowledge of plants is the appeal of Dr. Hylander's work directed.

"This book was planned and written with the specific purpose of making the layman familiar with a few of the interesting plants, both native and introduced, which are found in the United States," states the author. To be sure, it serves this purpose well and in addition it develops very interestingly some of the near-philosophical aspects of plant study which, regrettably, are too often undeveloped and unappreciated.

Before entering into a more detailed discussion of the subject matter and the method of presentation it should be impressed that seldom does there appear a work so beautifully illustrated. The one hundred and ninety-five, full-page, black and white photographs show a definite and pleasing artistry that all can appreciate but few attain. The plant subjects stand out perfectly and harmoniously like the living things that they are. The line drawings, approximately two hundred and forty sets of them with one to several subjects in each set, are full and accurate. All in all, the illustrations are much more than satisfactory.

The book opens with a sufficiently brief, fifteen page introduction in which the author develops the idea of the unique character of plant life and how it relates to the animal world. The distinctive features which differentiate plants and animals are interestingly portrayed and the heterogeneity of plants themselves is pointed out. The introduction concludes with an enumeration and brief discussion of the ten plant phyla, the first seven of which are most often ouped together under the Thallophyta.

Most of the remainder of the book, six hundred and twenty-four pages, is devoted to a discussion of the various plant groups, beginning with the lowest forms and proceeding through the highest. Of necessity it is essentially a taxonomic presentation, but two pleasant variations from normal procedure have fortunately been introduced. The first involves the minimum use of the highly technical descriptive terminalogy which so often marks a work of this kind. The second is the interjection of interesting chapters devoted to discussions of facts and ideas which are usually either entirely neglected in presentation or are permitted unwisely to languish. These chapters are developed as the text proceeds, whenever the appropriate time is at hand. For example, under Part One: "The Thallus Spore Plants (Thallophyta)," when the parasitic fungi are being discussed, a chapter on "Warfare Among Plants" is included. Another follows in which "Plant Co-operative Associations" (the lichens) are featured.

Part Two: "The Leafy Spore Plants (Bryophyta and Pteridophyta," and Part Three. "The Naked-Seed Plants (Spermatophyta: Gymnosperms)" are relatively brief but include several interesting sections such as "Amphibians of the Plant World" in the former and "The Most Primitive Seed Plants" in the latter.

By far the major portion of the book is devoted to the Angiosperms. Herein each chapter discusses related groups of plant families, and the classification in general follows that of Engler and Prantl. An idea of the approach may be gathered from Chapter 12, "The Catkin Plants" (Salicaceae, Betulaceae, Juglandaceae, Fagaceae, Casuarinaceae, Myricaceae, etc.). This chapter is placed under Part Four: "The Fruit-Seed Plants (Spermatophyta: Angiosperm Dicots)" and discusses the outstanding representatives of the included families. The titles of other chapters such as "The Laurel Family and Its Relatives," "The Maples and Their Relatives" and "The Composites" will serve to bring out the general approach. In addition, such sections as those on "Carnivorous Plants" and "The Beverage Plants" serve to relieve the formal pattern.

Part Five: "The Fruit-Seed Plants (Spermatophyta: Angiosperm-Monocots)" follows the same system, with such chapters as the two on "Plant

Epiphytes, Saprophytes and Parasites" and "Aquatic Seed Plants" raising the general tone of the discourse.

The book concludes with two appendices, the one a check-list of species classified as to phylum, class, order, and family (with the common name of each species), and the other a reading list of references by chapters.

It is obvious that such a book as *The World of Plant Life* is of little technical assistance to the forester in his work, but for anyone who has an inherent liking for plants in general and for him who is inclined to become more familiar with the plant world as a whole the book offers a great deal of pleasure.

JOHN H. HANLEY,
*University of Washington.*

**Timber Cropping in the Douglas Fir Region.** Prepared for the Joint Committee on Forestry authorized by the 75th Congress. By West Coast Lumbermen's Association and the Pacific Northwest Loggers Association. *37 pp. Illus. 1939.*

The lumber industry finds it has been doing its harvesting in a manner that will best provide for the growth of future crops. The clear-cutting method it has been following since the advent of high power machinery in the woods is ideal, in fact it is identical in its influence on reproduction with the prehistoric fires which swept through the Douglas fir region, destroying the old growth of that time and preparing the ground for the present mature forest of magnificent Douglas fir.

In a searching self-examination, the industry can find no flaws in its forest practices. The timber "cropping" method now followed, in place of the timber "mining" in the dark days before the Lumber Code, is almost perfection itself. Just one slight improvement is suggested by the industry. To accelerate the cropping system an increase in annual growth is desirable. To obtain this increase it is necessary to rid the land of all the old-growth trees which are standing idle, "like lumber in a pile." If the market were expanded, all of this old stuff that is not putting on new growth, or comparatively little, could be cleared out and room made for actively growing seedlings and thus offset the current depletion by the annual growth of this vigorous young forest.

Although the industry feels satisfied with its own performance, there is much which the public should do to carry out its obligations. Practically everything that has been proposed in the past to assist the lumber industry and to alleviate its burdens, except the Fletcher bill, is recommended. It is made abundantly clear that this request for federal aid does not imply an approval of federal restriction or regulation. That part of the problem is much more satisfactory as it is now handled—through the state legislatures. The industry is confident, nay insistent, that the regulation which it proposes, from time to time, to the legislatures and thus has enacted into law is the only form of regulation that will meet the needs of the industry and of the forests. Not much of this type of regulation is necessary, apparently, as the industry—according to this report—has applied its excellent Forest Practice Rules almost universally by voluntary action.

There are some statements in the report that might be open to question, such as:

1. The validity of including in the amount "spent by the operators and timberland owners to insure future forest crops in the region" such items as, patrol in the logging operation, fire protection equipment in the operation, slash disposal, and fighting fire caused by the logging operation. It would seem that these costs might more properly be charged against the logging operation than against the future forests.

2. The idea that "cropping" means, primarily, harvesting the commercially mature growth to make room for seedlings. There are now available for seedlings about 4.4 million acres of deforested burns and nonrestocked cutovers in the Douglas fir region.

3. The contention that clear-cutting must be the standard of forest management for the region. Kirkland and Brandstrom's studies of selective timber management show clearly the necessity of leaving trees and areas of growing timber to put on increased quality and size while the overmature trees and areas are being marketed. The lumber industry in this region is built upon high-quality, old-growth timber products. Selective management would provide a continuous supply of this type of material, and permit a permanent lumber industry.

4. The statement that mature timber should continue to be cut at least as rapidly as it is now being cut. Cowlin's analysis of the Survey data shows that the cut in western Washington will

have to be reduced about 48 percent to get on to a sustained-yield basis. Cowlin bases his estimates on the average cutting depletion for the period 1925-1933 which, he states, was 7.9 billion board feet for the Douglas fir region. He cites, also, that the 1937 cut was about 600 million board feet greater than this average. According to Cowlin, the Central Puget Sound Unit, which has the highest annual cut of any unit in the whole Douglas fir region, will have to reduce its cut about 59 percent to get on to a sustained-yield basis.

5. The theory that better markets would result in a greater incentive for sustained-yield forestry. To attain a sustained yield, every unit in western Washington will have to reduce its rate of depletion. It does not seem logical that an increased demand for timber and timber products would be an incentive to the operators to make this curtailment in their cut. Better markets would result in a more rapid depletion of the operable mature timber. A sustained yield of saw timber cannot be maintained in this region with immature second-growth timber and reproduction alone, no matter how much annual increment is being put on.

6. The idea that the operators' responsibility for increased fire hazard of logged-off land, as compared with the same land before logging, ends when the slash is burned. The public is too careless, but not all the blame for the fires on cutovers can be heaped on its shoulders after the operators have increased the risk from 15 to 20 times what it was before the logging of the timber, without any comparable increase in protection.

7. That the forest problem in this region is fundamentally one of markets. The forest problem here appears to be fundamentally one of getting on to a sustained-yield basis. There is enough mature timber in various ownerships which would, if it were blocked up, the cut reduced, and selective management followed, make many sustained-yield units possible and profitable. On the other hand, if clear-cutting is continued at the present rate, or even worse, accelerated in response to an expansion of markets, there will soon be too little saw timber of high quality left on which to base a sustained-yield program over most of the northern part of the Douglas fir region.

If the recommendations of the report were to be put into effect our forest problem, namely, making the transition from the exploitation of mature timber to a policy of sustained-yield forestry, would be aggravated and soon impossible of solution for much of the Douglas fir region.

ALVIN J. SELTZER,
*Seattle, Wash.*

**The Contents of Vessels of Fraxinus Americana with Respect to the Ascent of Sap.** By R. D. Preston. *Annals of Botany (N. S.) 2: 1-22. 1938.*

The mechanism of the rise of sap in trees and of the physiological function of vessels in the sapwood has always been an unsolved and intriguing problem. It is of specific interest to the silviculturist. Preston's researches throw new light on the behavior of vessels in ring-porous trees.

The research, begun in the spring of 1934, was carried on at Cornell University. Four trees of *Fraxinus americana* 10 to 12 meters high and 30 cm. in diameter were used.

An ingenious method is described of determining the contents and conditions of vessels in living trees by measuring the rate of inflow and movement of diluted India ink, when a vessel is cut under the solution. A strip of bark was peeled from a portion of the living tree and the rate of movement within the newly formed vessels determined visually. Since the initial rate of movement of the ink may be as high as 100 cm. per second, a stop watch was entirely inadequate, but a motion picture camera was used with satisfactory results. Diameters of the injected vessels were measured with a magnifying glass. Naturally, only those vessels exposed by removal of the bark could be observed.

As the lengths and connections of the vessels are important in the deductions, this question is briefly discussed. In 1935, at Leeds, the author showed that in ring-porous trees such as ash the vessels seem to be continuous and uninterrupted the entire distance from leaf to root. In the diffuse-porous trees, however, they terminate by an end wall in several inches to several feet. In maple they are 2 to 3 feet in length. So-called root pressure is regarded as totally inadequate as a driving force in the liquid movement, and therefore the force of root pressure is disregarded in these experiments.

Procedure was as follows: (1) A strip of bark was removed so as to expose the vessels. (2) A cut was made with a sharp knife underneath the liquid India ink. (3) The rate of movement up or down the vessel was measured (photographed by motion picture camera). (4) Poiseuille's law for rate of flow of liquid through clear, smooth, round tubes is assumed to apply to the force causing the flow in the vessel.

If the force causing the flow is $P$, [dynes per sq. cm.] $v$ the velocity, $L$ the length of the moving liquid column, $n$ the viscosity of the liquid, and $r$ radius of tube,

$$P = \frac{8n}{r^2} Lv.$$

This is true for steady flow only, where there is no acceleration. These calculations assume a tube of circular section of uniform size with no restrictions. The effect of deviations from this ideal are concluded to be reasonably negligible.

Three possibilities arise regarding the inflow of the ink:—

1. That the vessels are initially empty of liquid and contain a partial vacuum.

2. That the vessels are initially full of liquid which is already moving upward to the leaves by the tension caused by the leaves.

3. That the vessels are initially full of liquid under considerable tension great enough to contract their walls elastically so that when the tension is relieved by puncturing, the walls expand elastically.

By noting the rate of injection of the ink it presumably may be determined by mathematical calculations which of these three conditions existed originally in the injected vessel.

From this mathematical analysis, based on numerous measurements, Preston concludes that in *Fraxinus americana* many of the sapwood vessels are empty of liquid and contain gas under pressure of 0.4 to 0.9 atmospheres, and that other vessels are full of liquid under tension. In the case of *Acer* the empty vessels are located farther from the surface than those containing continuous liquid columns. As empty vessels are presumably functionless as conductors of water, Preston suggests that the whole question of sap ascent needs reconsideration.

HARRY D. TIEMANN,
*U. S. Forest Products Laboratory.*

**Factors Affecting Establishment of Douglas Fir Seedlings.** By Leo A. Isaac. *U. S. Dept. Agric. Circ. 486. 45 pp. Illus. Government Printing Office, Washington, D. C. 1938. 10 cents.*

Factors affecting the establishment of natural reproduction may be determined in two ways. One is to infer, first, what factors are most likely to have a direct bearing on establishment and then study the behavior of seedlings under conditions in which the various factors are artificially controlled. The other is to measure the physical factors involved and then correlate these measurements with the behavior of seedlings. One of the chief merits of the instrumental method is that it supplies concrete information useful in making comparisons. Whether it leads to a more correct interpretation or quicker solution of a given problem than the other method may be questioned.

Circular 486 presents and discusses the results of a study dealing with factors that influence regeneration of Douglas fir in western Washington and western Oregon. The study was conducted over a period of five years, in the vicinity of the Wind River Experimental Forest near Carson, Wash. As the author states, "The purpose of the study was to measure what appear to be the governing environmental factors on typical logged and slash-burned areas in a given locality, and to correlate the resultant measurements with Douglas fir seedling establishment or failure."

The factors measured were air and soil temperatures, evaporation, solar radiant energy, soil moisture, and precipitation. Measurements were made simultaneously on three adjoining areas which differed primarily with respect to amount of plant cover. One area had recently been cut over and severely slash-burned and had practically no plant cover; one had been lightly burned five years earlier and had a moderately heavy brush cover; and the third was a strip of virgin forest separating the first two. On each of these areas parallel plots were laid out for studying the behavior of seedlings. Because natural seeding was inadequate, seed was sown in spots protected by screens.

A major portion of the circular is devoted to the presentation and discussion of the measurements of physical factors. The graphic figures are especially interesting and informative. An important finding is that Douglas fir seedlings starting on exposed fire-blackened soils are quick-

ly killed because of high surface-soil temperatures. "A surface soil temperature of 123° F. for several days following germination is likely to injure Douglas fir seedlings and one of 125° or more is likely to kill them." It is interesting to note that these high surface-soil temperatures occurred when the air temperature was only 80°. Maximum surface temperatures were found to be considerably higher in shade, and in the open they were higher on a fire-blackened soil surface than on a natural soil surface. As would be expected, seedling losses were correspondingly less on natural soil surfaces. Next to high surface-soil temperatures, deficiency in soil-moisture content was responsible for the death of many seedlings. There appears, however, to be no definite point at which seedlings begin to die of drought. for some seedlings died when the moisture content was well about the wilting point. The author states that this ". . . is evidence that the wilting point determinations did not tell the whole storv." In the reviewer's opinion the act of wilting should be regarded as the result of disturbance in "water balance" within the plant itself. In other words, plants may wilt if the water loss from evaporation proceeds at a more rapid rate than absorption by the roots, even though sufficient soil moisture is present. This would also seem to explain why seedlings growing in "living" shade may survive even though soil moisture content may be relatively low.

As the author points out, it is lack of rainfall during the growing season that indirectly, because of its effect on soil temperature and soil moisture, governs seedling establishment in the region concerned. Although the average annual rainfall is approximately 84 inches, most of it occurs in the fall, winter, and spring. July and August, on the other hand, are dry. As seed generally germinates in May or early June, the seedlings are subjected to a drought just when they are least capable of withstanding it. It is in this respect that climatic conditions are much more unfavorable for seedling establishment than they are in southern New Mexico, in which region the reviewer has during the past 8 years conducted similar studies of factors affecting the establishment of Douglas fir seedlings. There, the dry months are April and May, and July and August are characteristically "wet." As a rule germination does not start before the advent of the summer rains, about July 1 to 15. Seedlings are, therefore, not subjected to a prolonged period of drought. Nevertheless, even as short a period as 10 days without rain is frequently fatal to seedlings unless they receive some shade. Although no quantitative measurements of temperature and moisture were taken, observations of the behavior of seedlings under various conditions of site and cover have clearly demonstrated that in the New Mexico region shade is also an important factor governing the establishment of Douglas fir seedlings.[1] Likewise, "dead" shade (slash, logs, and lath frames) is more beneficial than "living" shade (vegetation which competes for soil moisture and plant food).

The reviewer agrees that "since nothing can be done about the weather," one means of bringing about better restocking is to provide more favorable ground conditions for seedling establishment through modification of logging practice. He wonders, however, if the author is justified in concluding that this alone will solve the problem. May it not be that the control of rodents will also be necessary? In 1930, when the protective screens were removed from the seed spots, 50 percent of the seedlings were killed by mice. This would seem to indicate that rodents are a big factor. The results of the studies in southern New Mexico have thus far indicated that in this region the influence of rodents in preventing establishment of reproduction far exceeds that of any other factor.

HERMANN KRAUCH,
*Southwestern Forest & Range Experiment Station.*

**An Outline of General Forestry.** By Joseph S. Illick. *Third edition, revised and enlarged. 297 pp. Illus. Barnes and Noble, New York. 1939. $1.*

The first edition of Dr. Illick's *Outline of General Forestry*, published in 1935, was reviewed by the present writer (Jour. Forestry 33: 944-945) who called attention to the book's numerous merits, particularly its brief but comprehensive presentation of the whole field of forestry, its timeliness, and, finally, its very reasonable price. All that was said of the first edition applies equally to the third. In this new edition several chapters have been completely rewritten; others have been added.

[1]Krauch, Hermann. Some factors influencing Douglas fir reproduction in the Southwest. Jour. Forestry, 34(6). 1936.

As regards forestry in America the book is as up-to-date as today's newspaper. Therein lies its value, not alone to the forestry student, but to the professional worker and especially to the layman with an intelligent interest in the subject.

Designed as an introduction to forestry rather than as a general textbook, the outline is useful primarily as a source of information about all phases of forestry and other closely related branches of conservation. Readers who desire to obtain more detailed knowledge about any particular phase will be guided by an unusually large number of references following each of the 31 chapters.

Especially recommended to the practicing forester who desires to keep informed of progress in the profession are the chapters "Progress in Federal Forestry," "Progress in State Forestry," and "County, Municipal, and Private Forestry." Another chapter, which should be interesting to the student as well as to the practitioner, is "Work Opportunities in Forestry." Although short, the final chapter, "Significant Trends in Forestry," answers with restrained optimism the important questions of what forestry is doing, how it is developing, and where it is headed.

HENRY E. CLEPPER.

**Oregon Looks Ahead.** By V. B. Stanbery, Executive Secretary. *93 pp. Illus. Oregon State Planning Board, Portland, Oreg. 1938.*

"This book presents in condensed form significant facts about Oregon—its resources, opportunities, problems, and needs. It shows how the state's resources can be conserved and developed for greater use, and what can be done by public and private enterprise toward reducing waste and providing larger benefits for all." Thus, the foreword well summarizes the contents of the publication.

This report is an excellent example of work now being done by state planning boards. It shows thoughtful consideration for Oregon of the advantages and disadvantages of location; of population and employment problems; of manufacturing industries; of resources and their conservation; and of the future development of the state. It brings out clearly the mountainous topography, the climatic variety and other factors which contribute to multiplicity of resources. These, if subjected to balanced use, can provide excellent living conditions for the state's population.

Of special interest is reference to the "Willamette Valley Project." This project, covering 12,000 square miles of the Willamette River drainage basin, is unique in correlating within a relatively small area the development of extensive forests, of water power, of irrigation, of varied agricultural productivity, and of other resources. Owing to the thriving communities already present careful planning of future development should here pay large dividends in prevention of waste if it can anywhere.

B. P. KIRKLAND,
*U. S. Forest Service.*

**The Primary Wood-Using Industry of the Lower Peninsula of Michigan for the Year 1935.** By Willett F. Ramsdell. *ix + 130 pp. Illus. (Multilith.) Univ. Michigan School of Forestry and Conservation Bull. 8. 1937.*

This bulletin gives the results of a comprehensive survey of the production for commercial use of wood products from the log or bolt in southern Michigan. Neither fuelwood nor any other of the round products cut and used directly by farmers and other landowners is included. Data on the area and stand of timber resulting from the Forest Survey of the Forest Service are also presented.

Detailed statistics are shown, for each county, on sawmill production and employment by size-classes of mills based on normal annual cut, and the total production is also given for each county by classes of products and kinds of wood. These data are shown in summary tables for the Lower Peninsula and for the northern ("forestry-recreation area") and southern ("farm woodlot area") sections into which it is divided. Figures are also included on mills classified as to size, relative stumpage supply, character of market for product, custom sawing, utilization practice, methods of log transportation and type of sawmill and power plant.

The completeness of the data was made possible by the method of collecting the information, which was by personal interview. It is unfortunate that a direct comparison cannot be made

with lumber production figures collected by the Bureau of the Census for the same year; the latter, however, are available only for the entire state. Adding together the sawed products shown in the report gives approximately 113 milllion board feet for the Lower Peninsula compared with nearly 333 million board feet for the state, as reported to the Census. Inasmuch as little oak is cut in the Upper Peninsula of Michigan it seems that the cut of 24 million feet given in the report might be nearly comparable to the 5 million feet given by the Census for the state. However, mills cutting less than 50 M board feet were not included in the Census canvass and, although according to the Michigan bulletin about 90 percent of the total lumber produced was cut by larger mills, the oak lumber may have been cut by small mills to a greater extent than many of the other woods. There seems to be no way of making a direct comparison, therefore, between the two sets of statistics. The Michigan bulletin gives 804 sawmills in the Lower Peninsula producing lumber and sawed ties, of which 425 cut 50 M feet and over, compared to 159 in the state reported by the Census. The fact that 88 percent of these were of the portable type and that mills of all types operated on the average only 33 days in the year is probably responsible for the mail canvass of the Census missing a great many mills.

The large amount of detailed data in this bulletin gives an excellent picture of the extent and value of the timber industry in the area covered.

W. D. Brush,
*U. S. Forest Service.*

**The C.C.C. and Wildlife.** By U. S. Biological Survey. *18 pp., Illus. Government Printing Office, Washington, D. C. 1939.*

This booklet, well illustrated photographically, tells the story of what the Civilian Conservation Corps is doing under the Biological Survey and other federal and state agencies cooperating in C.C.C. work.

The principal types of work to advance the national wildlife restoration program are forest fire protection, planting for feed and cover, development of refuges, sanctuaries and feeding grounds, construction of fish hatcheries and game farms, planting fish, and winter feeding of game.

In addition to the work directly related to wildlife development, many of the general conservation projects indirectly improve wildlife conditions. Water control, soil conservation, and forest planting all have a positive influence in improvement of game habitats.

The introduction of the booklet tells the story of the exploitation of wild creatures and draws contrasting pictures of wildlife conditions in this country at the beginning and end of the Twentieth Century. The coming of the C.C.C. with its plentiful labor was at the opportune time to put into operation the long-awaited national program for restoration of wildlife.

The booklet is for free distribution from the Corps or the Bureau of Biological Survey, Washington, D. C.

G. H. Hieronymus,
*Civilian Conservation Corps.*

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